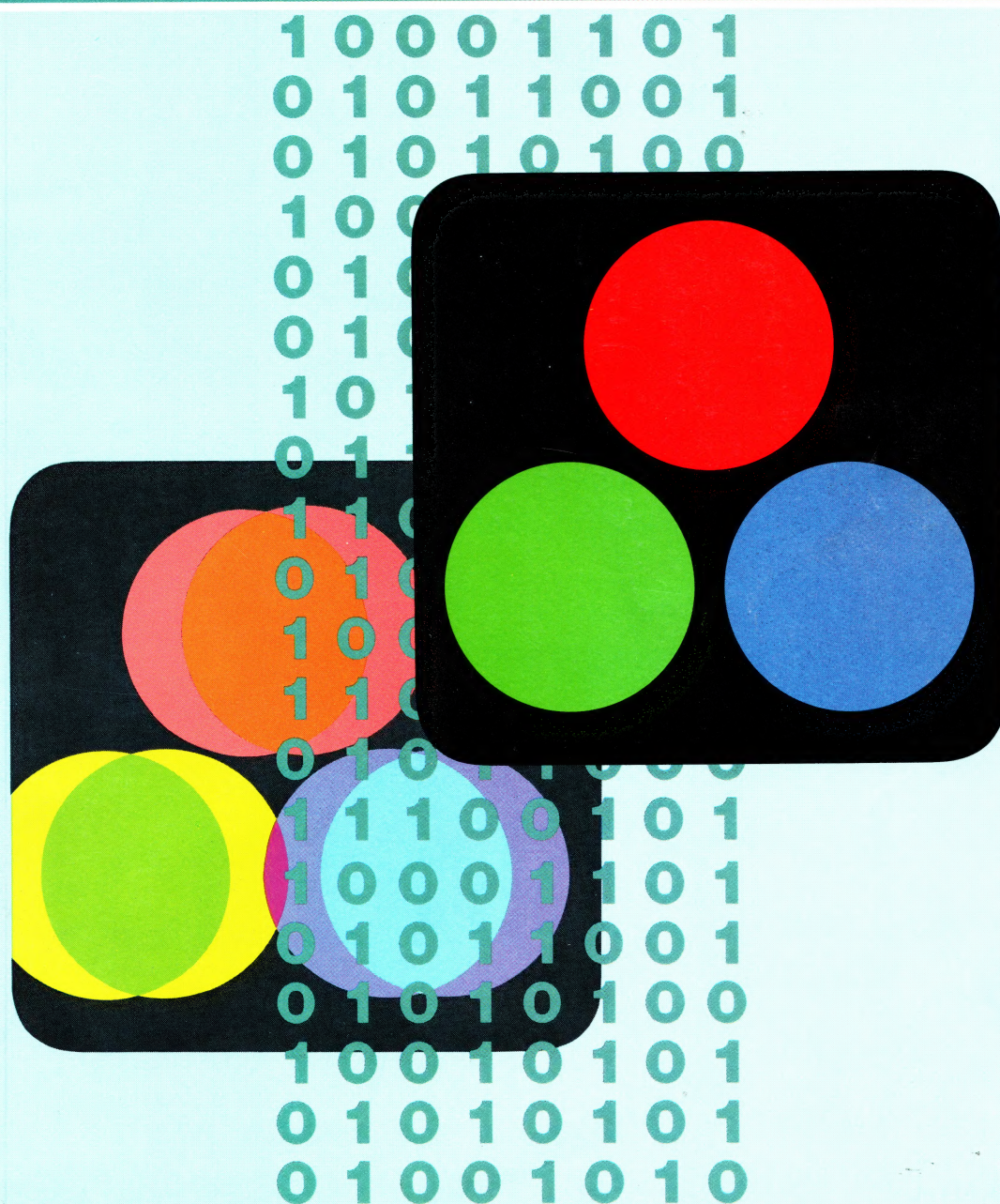


ElectronicsWeek®

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Rescreening integrated circuits helps infant mortality problems/55

Design strategies for today's local networks/60

HP's 3488A Switch/Control Unit

HP's off-the-shelf switching solution...for fast, flexible switching system implementation.

Just because your latest product requires a custom test set-up to run it through its paces, that's no reason for having to fight with designing a custom switch system as well. The HP 3488A Switch/Control Unit is your low cost, HP-IB compatible, off-the-shelf alternative to that old bane of test system design—the custom designed, hard-to-support, undocumented in-house switching system.

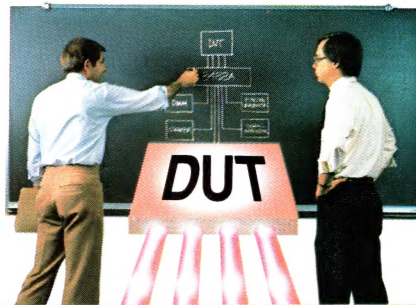
The HP 3488A fits most electronic test signal switching needs. With its five-slot card cage it can accept any combination of wideband VHF switch modules, general purpose and multiplexer relay cards, 4x4 matrix switch modules, and 16-bit digital I/O cards to give you a flexible, affordable solution for automated testing. You can mix and match switch modules to meet your measurement needs. In production or in design and development, the HP 3488A's fast hookup and easy programming gets your test systems

out of the starting blocks fast. Its excellent signal integrity and isolation ($< -85\text{dB}$ crosstalk at 100 MHz) means you get good, accurate DC-300 MHz VHF measurements with confidence, every time. Its 250V/2A switching with $< 3\mu\text{V}$ offsets means dependable versatility for broad-based problem solving. Programming errors or device connection inconsistencies are easily traced using the HP 3488A's alphanumeric front panel display and built-in card monitor facility. On-board memory

stores up to 40 complete switch configurations, which can be individually accessed via a single command, for simplified programming and fast system debugging.

The HP 3488A Switch/Control Unit brings rapid and reliable automated switching to your automated testing applications. Use it and HP's other low cost measurement tools to build an affordable automated test system custom tailored to your individual needs.

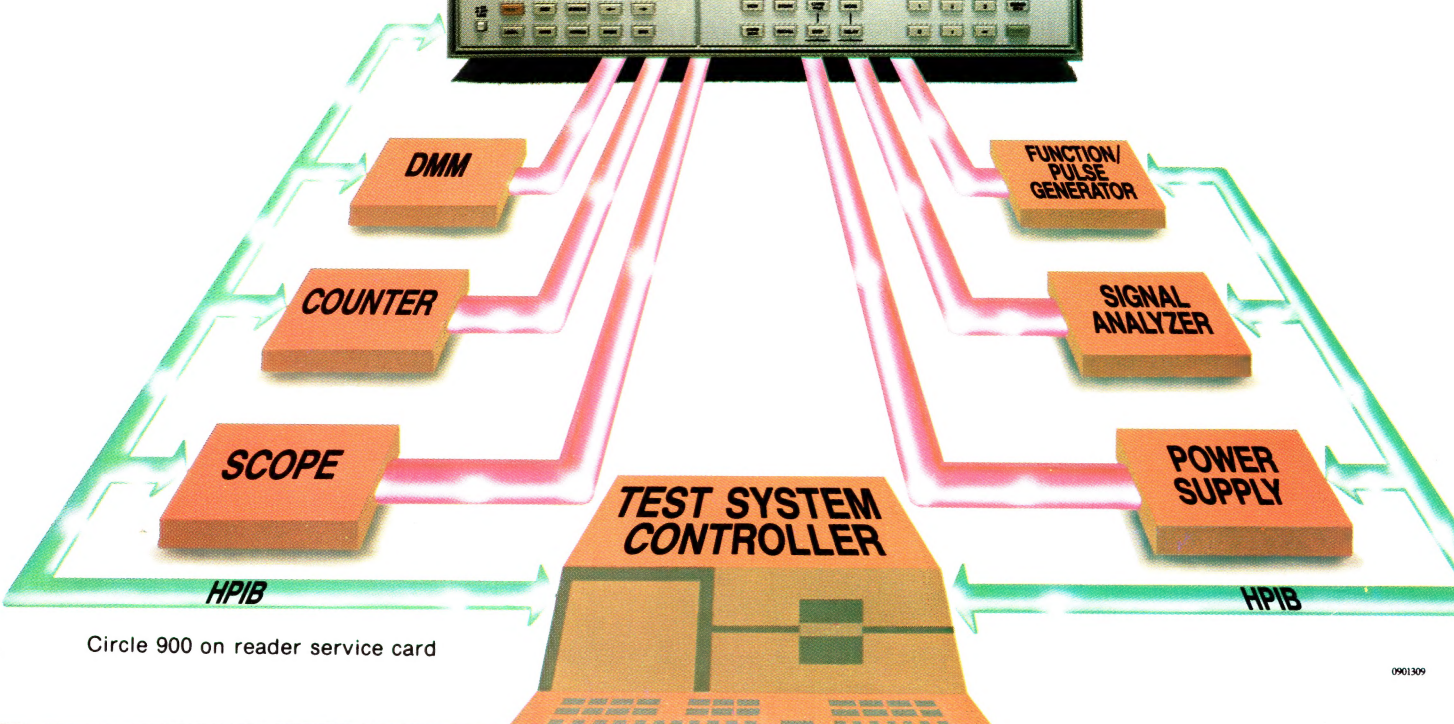
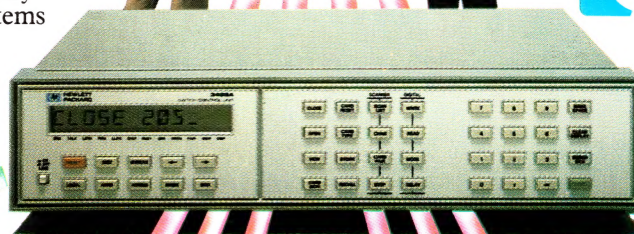
For a copy of our informative application note AN328-1 "Practical IEEE-488 (HP-IB) Systems Switching," circle the reader service number below. Or, call your local HP sales office listed in the telephone directory white pages, and ask for an HP field engineer in the electronic instruments department.



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ElectronicsWeek

IBM-EC
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Video Digital TV sets improve viewing. As digital TV circuitry continues to improve, manufacturers start to introduce

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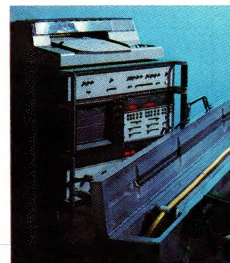
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ElectronicsWeek

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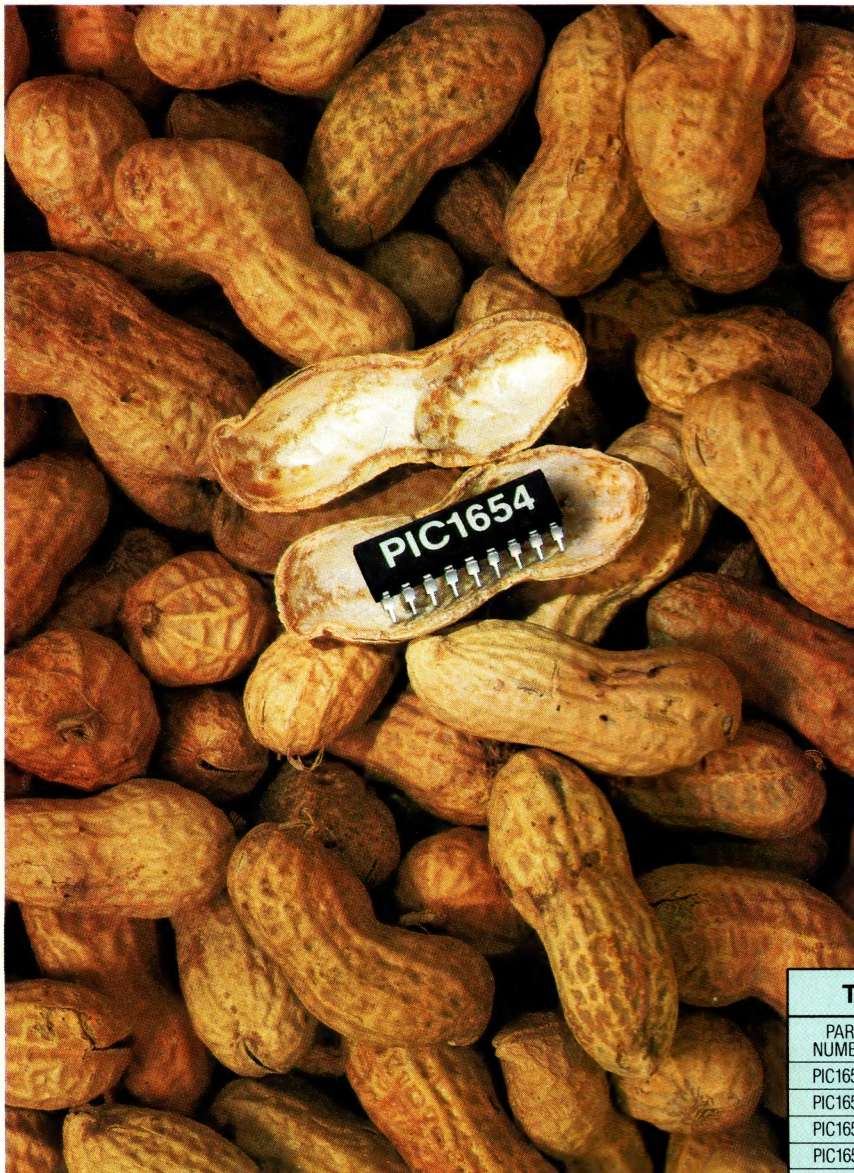
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In a nutshell: The Smallest 8-Bit Microcomputer



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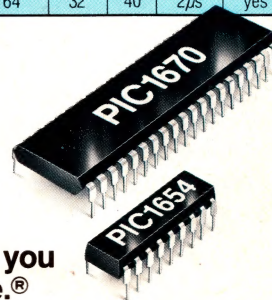
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PART NUMBER	ROM SIZE	RAM (BYTES)	I/O LINES	DIP	INSTR. SPEED	INTER-PTS
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PIC1652	256 x 12	32	12	18	$2\mu\text{s}$	no
PIC1654	512 x 12	32	12	18	$2\mu\text{s}$	no
PIC1655A	512 x 12	32	20	28	$4\mu\text{s}$	no
PIC1657	512 x 12	32	20	28	$2\mu\text{s}$	no
PIC16C58	512 x 12	32	20	28	$4\mu\text{s}$	no
PIC1670	1024 x 13	64	32	40	$2\mu\text{s}$	yes
PIC1672	2048 x 13	64	32	40	$2\mu\text{s}$	yes

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Next ElectronicsWeek

Faster, less expensive data conversion is coming

As signal-processing techniques continue to advance, increasing demand for faster and more complex analog-to-digital and digital-to-analog conversion is becoming evident. Will monolithic converters therefore supplant hybrid and modular units? Find out in Components Editor Ashok Bindra's special report, the next *ElectronicsWeek* cover story.

Automated structured analysis gathers speed

Recent developments in automating structured analysis are removing many problems associated with manual applications of the technique. An automated approach lends itself to higher productivity levels in software engineering and may become the principal method for software design in the later part of the 1980s. Norman L. Kerth of Tektronix will explain structured analysis and its technique in the next *ElectronicsWeek*.

Looking ahead in ElectronicsWeek

Military semiconductor marching orders

With the military semiconductor market reaching \$2.6 billion by 1988, digital signal processors and gallium-arsenide devices are heading the Department of Defense's "most wanted" list. The DOD also expects to be looking for a lot more CMOS logic and memory. Read about the needs of the world's biggest buyer in an upcoming *ElectronicsWeek*.

New trends in distribution

George Leopold, of our New York bureau, is heading up an *ElectronicsWeek* special report that examines the new business of electronics products distribution. The report will detail the new realities that are changing everything from component distribution to semicustom integrated-circuits shipments.

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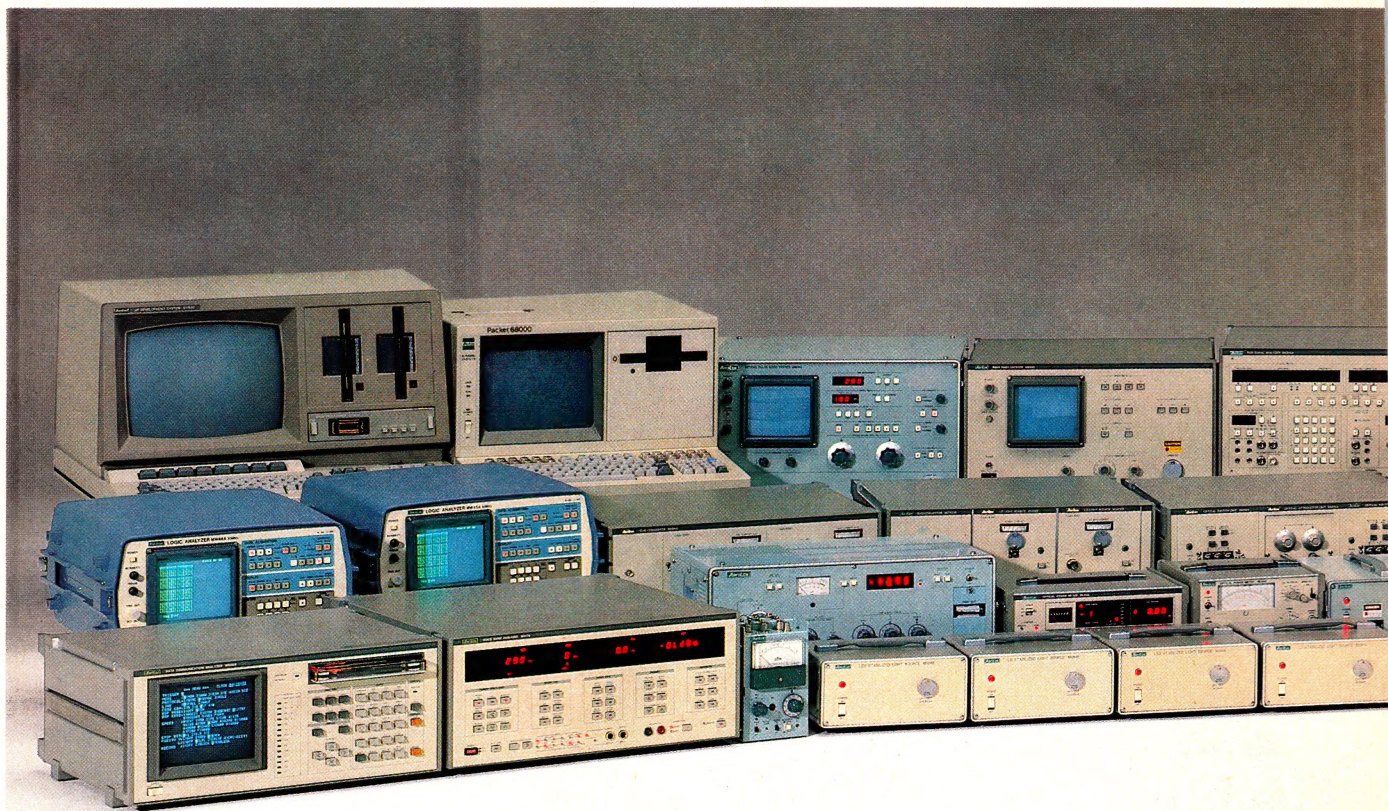
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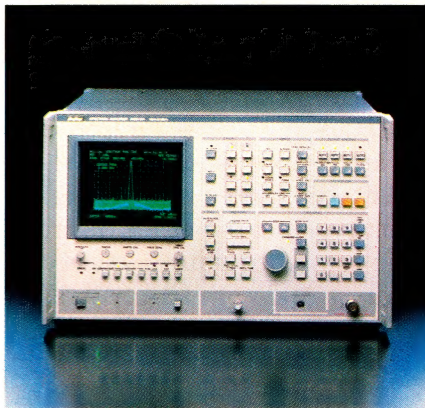
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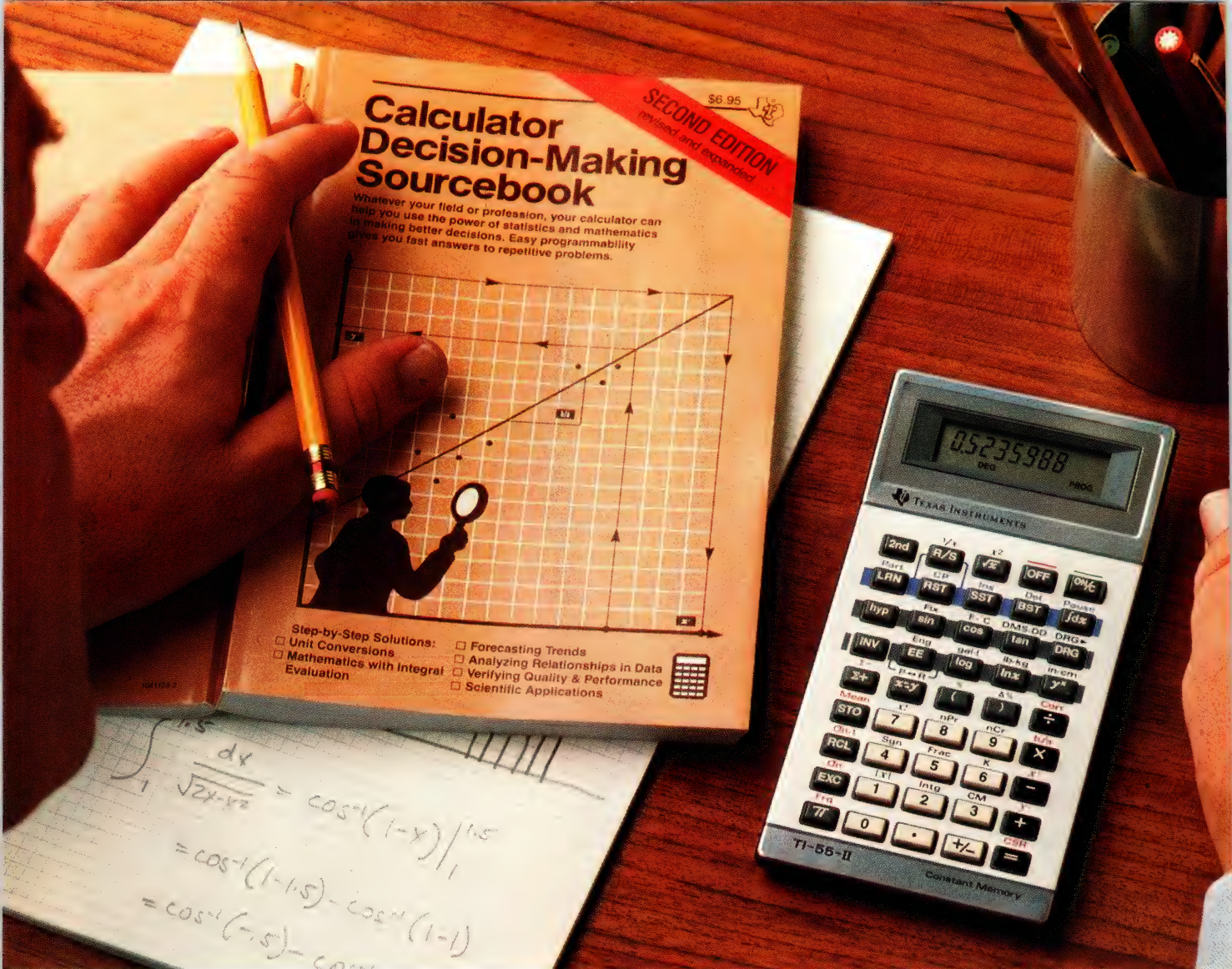
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ARTIFICIAL VISION LOOKS GOOD TO GENERAL MOTORS

In its drive to speed up the advent of advanced manufacturing, auto giant

buys interest in three machine vision firms □ by Wesley R. Iversen

Detroit

In the latest of a series of moves aimed at accelerating the application of advanced manufacturing technologies into its factories, General Motors Corp. is planning to pump millions of new dollars into the development of artificial vision technology.

The automaker says it is buying a minority stake in three outside vision suppliers—Automatix Inc., Diffracto Ltd., and View Engineering Inc. It intends to fund development projects for GM applications and to give the firms access to select portions of GM's own machine intelligence technologies.

Reached in principle with three companies that are already considered to be among the leaders in the artificial-vision field, the agreements [*ElectronicsWeek*, Aug. 6, 1984, p. 24], are the kind that others in the fledgling industry would give their eye teeth to have. With more than 70 artificial vision firms now competing in the U.S., a partnership with GM would be an added edge in pursuit of a total market that observers agree could top \$1 billion by decade's end.

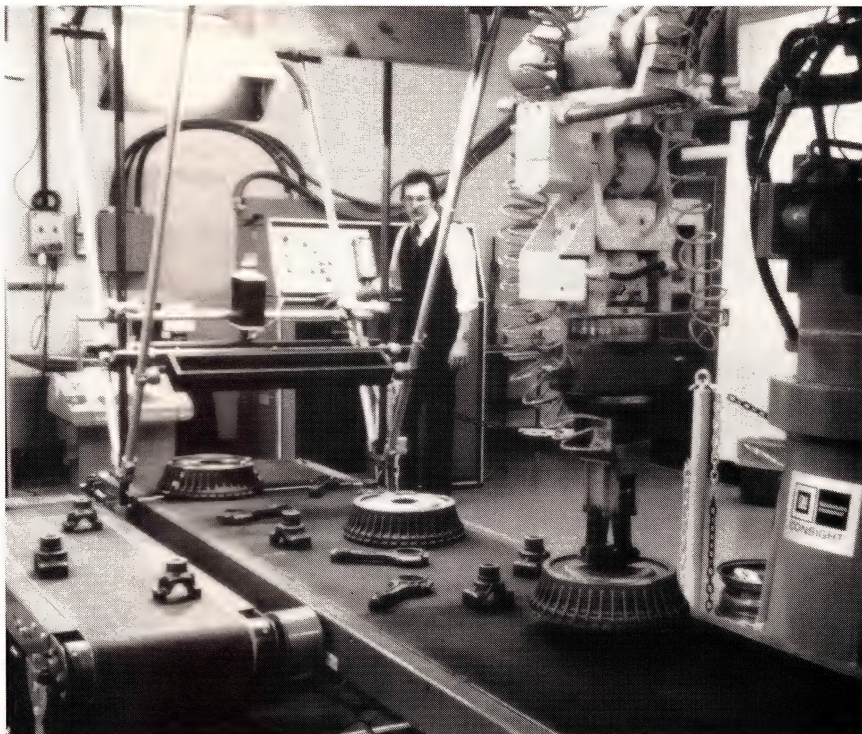
Big spender. "We think this is going to be very significant, since GM is the world's largest customer for artificial-vision systems," says Philippe Villers, chairman of Automatix. GM will initially purchase a 10% interest for about \$12 million—pro-viding needed capital that the four-year-old Billerica, Mass., firm otherwise might have had trouble raising, says Laura Conigliaro,

an industry analyst for Prudential-Bache Securities, in New York.

To Villers, GM funding of Automatix research projects for target GM applications is equally important. "It will mean product offerings [from Automatix] optimized for their [GM's] needs, greatly strengthening our market to GM, while at the same time allowing us to retain our independence and therefore our ability to serve our many other customers." He adds that the deal will

improve Automatix prospects generally, since other customers "will probably be impressed by the fact that the world's largest and most experienced user decided to form this relationship with Automatix."

Similar comments come from officials at 10-year-old Diffracto Ltd., of Windsor, Ont., Canada, and View Engineering, Simi Valley, Calif. "Probably the most important thing for us is the preferred position at GM that this provides us," says



Look, then act. This industrial robot developed at GM's technical center "sees" parts as they start down the conveyor belt (left) and passes on the information to a computer. As parts reach the robot, the computer orders it to pick them up and instructs the robot what to do with them.

Richard A. Hubach, View Engineering's president. The deal could in fact pay off particularly for his firm, since GM has accounted for less than 10% of its sales. Automatix and Diffracto have relied on GM for 30% or more of annual sales.

Besides the positive effects on the selected vendors, View Engineering's Hubach says the GM move is apt to pay dividends for other suppliers by boosting the credibility of industrial vision technology in general. "What it does is put us in a position where other industries besides automotive will recognize that this technology is real, and that's a battle that we've been fighting for years," says the cofounder of the eight-year-old company.

Partners. For GM, the plunge into partnership with outside vision suppliers will augment about a dozen years of ongoing internal development in machine vision. But it represents only the latest in a series of moves that signal a new GM aggressiveness in acquiring, applying, and exploiting advanced manufacturing and computer technologies.

Most spectacular was the firm's recent announcement of its \$2.5 billion deal to acquire Electronic Data Systems Corp., a Dallas computer-services company [*ElectronicsWeek*, July 30, 1984, p. 46]. Other moves include the automaker's leadership role in pushing the establishment of a manufacturing automation protocol that would make it easier to link automated manufacturing systems [*ElectronicsWeek*, July 23, 1984, p. 45] and its bid for a 13% stake for about \$3 million in Tecknowledge Inc., a developer of artificial-intelligence-based expert systems.

GM's manager of machine intelligence, Frank Caiati, considers the development of vision and related technologies essential in the company's push to improve quality and productivity and thus maintain competitiveness in world markets. "We think there's going to be a lot of machine-intelligence activity both in our industry and others and we're trying to make sure that GM is among the first to employ it effectively," he observes. (Though artificial vision has received the lion's share of attention to date, Caiati points out that other machine-intelligence techniques, such as tactile

image sensing, will also play a role in any future schemes for factory automation.)

GM has about 3,500 robots in use or on order, with plans to employ about 14,000 by 1990. But its use of industrial vision has been less extensive, Caiati indicates.

The number of vision systems that GM has in house is only "on the order of hundreds," he says. Most are used for parts inspection, identification, and measurement tasks, and many rely on older binary vision technology. Only a few systems use more advanced gray-scale and three-dimensional vision methods. Though the company is making limited use of vision-guided robots, says Caiati, "we really have none that have proliferated in any great numbers."

One thrust of the GM-funded near-term development efforts at the three vision system companies will be to make vision techniques now

used selectively within the firm more readily transferable between applications. "Vision is not a cookbook type of technology. It takes some applications engineering to get it to work," Caiati explains.

"What we'd like to do is minimize the differences from one application to another, but it's not simple with this kind of technology because it's so application-dependent." Process control and assembly are two target applications in which GM hopes to push the use of machine intelligence.

Among areas that need work, Caiati cites the development of new algorithms to do additional kinds of analysis on parts from those methods now possible. He mentions also the development of color vision systems. "There hasn't been a crying need, but on the other hand, if a good color analysis technology were available at a low price, it would probably get used more."

PACKAGING

TI and Intel skirmish over packages for megabit memories

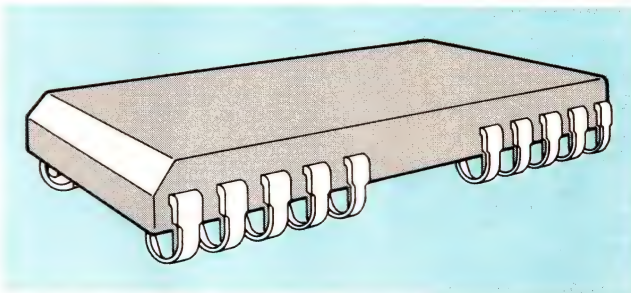
Houston—The growing use of surface-mountable semiconductors and the jump in die sizes for megabit memories are dramatically reshaping industry views on future trends in chip packaging. For previous generations of dynamic random-access memories, memory makers simply used the familiar 300-mil-wide plastic dual in-line package, but a more likely candidate on the horizon is a low-cost surface-mountable package.

That prospect has set off an un-

precedented discussion around the industry as DRAM merchants attempt to coordinate the shape of things to come. Already there are two opposing proposals from two industry heavyweights: Texas Instruments Inc. is promoting a package design that would stick with the 300-mil width, and Intel Corp. is presenting a design that would push the package width to 350 mils.

More active in its efforts to poll customers and competitors has been

Texas Instruments, which is proposing a package that is surface mounted and blends a little of the old with the new—its profile resembles a DIP but it has the J-leads of current plastic chip-carriers.



Quintets. TI's proposed 675-mil-by-300-mil package for megabit memories has four groups of five J-leads to separate functions.

The result is a 20-lead plastic surface-mountable package that TI believes will easily handle the large dies needed for 1- and 4-megabit chips and simplify printed-circuit-board layout as compared to the chip-carrier the firm pioneered for 64- and 256-K chips. In this concept, chips stay in a 300-mil-wide package instead of going into one 400 mils wide.

"The megabit RAM represents the first time that memory packaging will be determined by silicon size and not by the lead counts," notes Charles Hutchins, product engineering manager for advanced development activity with the TI Semiconductor Group in Houston.

This summer, Hutchins has been promoting TI's J-leaded small outline concept in Japan and the U.S. "I would say that we have gotten 90%-plus acceptance on the idea so far. We are currently working up the final dimensions of the package," he says, adding that TI is tooling up to produce the first internal prototypes within a month. In September, the proposal is expected to go before the Joint Electron Device Engineering Council's 43.2 memory committee.

However, Intel plans to promote a 350-by-550-mil J-leaded chip-carrier, which it believes is a better choice. This package has leads on all four sides of the housing, while TI's proposal divides the 20 leads into two rows on the long sides of the package.

Leaving a gap. The tentative dimensions of TI's new package call for a nominal length of 675 mils and a width of 300 mils. The footprint groups five J-leads at each end of the long sides, leaving a gap in the center (see drawing).

This layout places leads closer to the die's bonding pads, says Hutchins. What's more, it makes it possible to group control and data lines at one end of the package, with address lines at the other. The Intel package would achieve such separation by not using the leads at the center of each edge.

But Intel has doubts about the effect of changes in the shape of surface-mountable packages. "It could set the technology back five years," worries Patrick Brooks, product marketing manager in Hillsboro, Ore.

"With the plastic chip-carrier,

tooling already exists, as well as automatic handling, board insertion, and testing equipment," he adds. TI, however, is confident that installed equipment can handle the DIP-shaped package.

Still, RAM makers continue to worry that their initial megabit dies will not fit properly into the cavity of a 300-mil package like the one TI is proposing. With 400-mil widths,

many believe, dies can be better protected from contamination.

Yet TI believes chips should be elongated—making them about 450 to 500 mils by 170 to 180 mils. That would let chip makers hedge their move to surface-mounting by still being able to fit dies into 300-mil plastic DIPs, which may still house 20% to 30% of the next generation of chips.

—J. Robert Lineback

VOICE I/O

Olivetti uses compression code to cut voice I/O memory need

Ivrea, Italy—Research engineers at Ing. C. Olivetti & C. are getting closer to one of their highest-priority goals—that of enabling office workers to use spoken language for inputs to and outputs from sophisticated data-processing and office automation systems. The company already has several working prototypes of voice I/O tools that could signifi-

and longer development is expected.

Nonetheless, Olivetti feels it has recently made some important strides, and its machine is now able to distinguish, with high reliability, between words such as "make," "lake," and "take" after a five-minute session with the operator, who trains the machine by reading a set text. One key to the Olivetti recognition system is the company's proprietary method for establishing an "energy profile" of the operator's speech.

Olivetti's work in voice coding is more focused. The company sees the technique as the medium through which an electronic voice-message service that could be integrated into an office automation environment will be realized. There is no great difficulty in recording a voice using electronic media, particularly when a digital network serves as input.

What does present a problem is storing it without using a prohibitive amount of memory. A pulse-code-modulated signal at 64 kb/s, for example, requires 8-K bytes of memory to record 1 s of speech.

Olivetti has reduced this requirement by about 60% to 3-K bytes for a second of speech using a technique called adaptive delta PCM, which codes differences in the speech signal, rather than the entire signal. By



Talking box. Olivetti's prototype unit synthesizes numbers from an electronic typewriter for proofreading.

cantly cut the drudgery of many mundane office tasks and increase efficiency in other office routines.

The company's thrust is concentrated in the fields of voice coding, speech synthesis from text, and speech recognition. Olivetti has applications clearly mapped out in the first two cases, but its phoneme-based recognition program is by far the most ambitious of the three [*Electronics*, May 19, 1983, p. 88]

IBM shows wares, TI gets contract

suppressing or by coding the silence intervals the company has achieved a further reduction to 2.25-K bytes.

The company's prototype system lets the user choose whether to store messages at 4-, 3-, or 2.25-K bytes for a second of speech, the choice determining the quality of the recorded messages. Vittore Vittorelli, manager of the voice processing laboratory, points out that the quality of even the 2.25-K-byte coding is perfectly acceptable, with the difference being an esthetic one.

The system works by amplifying an incoming voice message, sending it through a low-pass filter, and then converting it into digital form for storage. To play back a message, it reverses this process. Olivetti's prototype can store only 7 s of speech in a random-access memory, but in practice such a memory will serve only as a buffer for storage on disk.

While voice coding is transparent in terms of language, speech synthesis and recognition confront a great many problems due to linguistic factors that are usually far from the world of electronics. In the case of synthesizing speech from text, those problems start with creating understandable, and then attractive, natural-sounding speech.

An ideal application for synthetic speech from text would be in proof-reading. The company has so far de-

veloped a prototype system that will record numbers from an electronic typewriter, and then read them back to the typist for checking.

This requires a far more sophisticated system than one might expect. If the typist types the number "221," for example, the system must translate that into the corresponding verbal expression "two hundred and twenty-one." In the case of actual text, the difficulty increases exponentially. "April 2nd" would thus become "April the second," and "Dr." would be expanded to "Doctor."

After this stage comes a conversion from text to phonetic symbols—relatively easy in Italian, devilishly difficult in English—after which syllable stress is assigned. In French, a further operation is required to determine "liaison," or connecting sounds between words.

After ambiguities are sorted out (like the difference between the homonyms "lead" and "lead"), the duration of each element of the phonetic string is determined and the appropriate pauses are inserted to divide the sentence into breathing groups. Finally, a semantic analysis corrects any improper assignment of pauses that could hinder or change comprehension, as in the two statements, "the sentence (pause) analysis is critical" and "the sentence analysis (pause) is critical."—**Robert Gallagher**

Austin, Texas—In a move to display its resources in the field of artificial intelligence, IBM Corp. last week gave a rare performance of software resulting from some of its most advanced AI research work. The presentation, made during the National Conference on Artificial Intelligence, held here, included a Lisp programming language product for IBM's VM operating system and a real-time expert system that assists human operators in keeping large computers running.

Some 200 miles north of the show, Texas Instruments Inc., of Dallas, also was making AI news. The firm was awarded a \$6 million contract from the Navy Electronics Systems Command, in Washington, D.C., to develop a compact Lisp machine, based on semiconductor technology. The project is part of U.S. efforts to embed advanced symbolic computing capabilities in military systems, and will span 27 months. Lisp is considered by many to be the leading programming language for AI work.

VHSIC offshoot. TI's Lisp machine will be based on a custom chip using 2- μ m complementary-MOS technology. The system will also contain high-speed static random-access memories, made from 1.25- μ m technology and developed earlier at TI for the Very High-Speed Integrated Circuits (VHSIC) program.

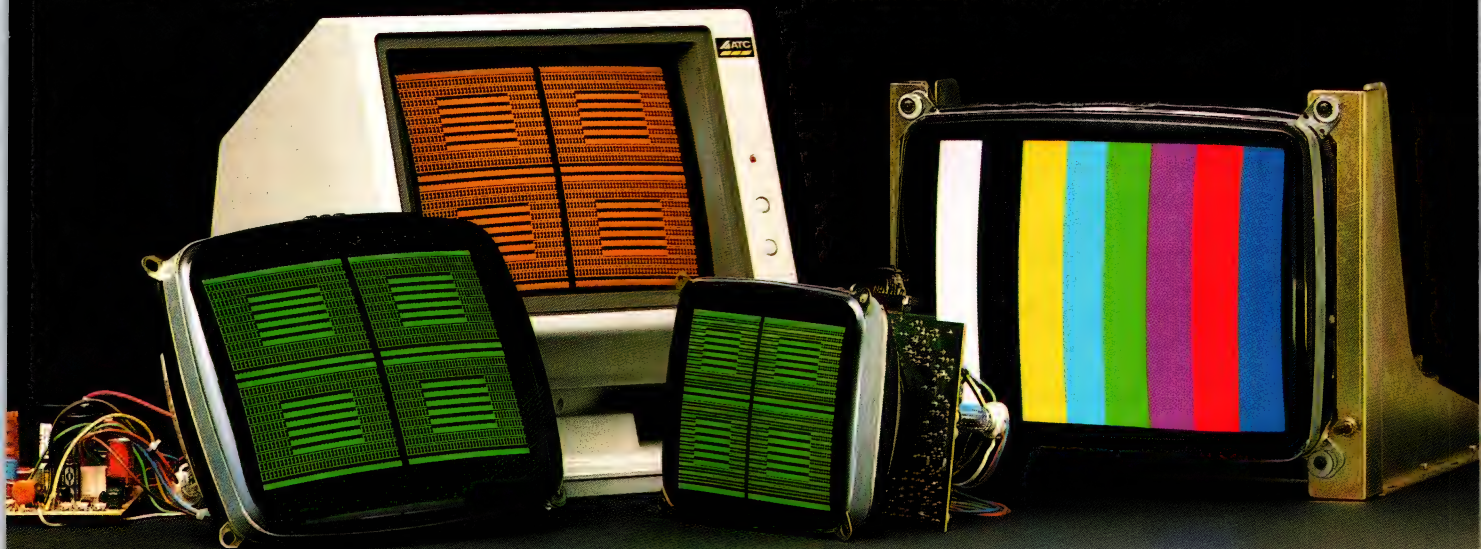
The custom chip will operate at speeds up to 40 MHz, TI says, and will result in a single-chip Lisp processor with 2 to 10 times the processing power of today's commercial symbolic processors.

At the AI show in Austin, 15 computer makers and software houses demonstrated their latest efforts in the field. And TI, at private showings in Austin, was showing new Lisp hardware that will likely soon be offered commercially. All are aiming at a piece of the AI market, which by some estimates will grow from \$150 million in 1984 to



Smart. Data General Corp. is the latest commercial entrant in the artificial intelligence field with its introduction of Common Lisp for its Eclipse MV family of 32-bit superminicomputers.

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\$2.5 billion in six years.

One of the show's debuts came from Data General Corp., of Westboro, Mass. It showed Common Lisp, a programming environment that runs on the firm's Eclipse MV family of 32-bit superminicomputers (see photograph, p. 14).

New opportunities. Xerox Corp. kicked off the establishment of an AI systems business unit, to be based in Pasadena, Calif. The firm says it created the unit in anticipation of significant increases in the AI marketplace during the next two to five years. It also unveiled an interface that connects IBM Personal Computers to the Xerox 1108 AI work station. The interface will be available in the first quarter of 1985.

In what many believe to be the most visible showing of IBM AI work, officials from the Research Division in Yorktown Heights, N.Y., demonstrated software that covers the range of the firm's hardware—from 380X mainframes to the desktop PC. The exhibit was an effort to show off IBM's brawn in AI to Japanese and U.S. competitors—especially those associated with the Microelectronics & Computer Technology Corp. consortium, in Austin. IBM has been conducting AI work since the 1950s, and is currently emphasizing such areas as expert systems, speech recognition, computer algebra, visual perception, handwriting recognition, natural language, and robotics.

No hands. A highlight of the IBM booth was an expert system called YES/MVS, which was developed in-house to keep large systems running without the intervention of human operators. The software manages the MVS operating system and is being used experimentally on a 380X mainframe at Yorktown Heights.

IBM also demonstrated an internal computer algebra program, dubbed Scratchpad II. Beginners can use it for interactive work and experts can use it to describe and manipulate algorithms and algebraic structures.

An experimental tool to create AI interfaces for IBM's PC was also exhibited at the conference. Called Handy, the tool allows designers to create interactive interfaces with windowing capabilities, color animation, graphics, speech synthesis, and video.

—J. Robert Lineback

CONSUMER

Simple, low-cost videotex terminal may burst through home-use barrier

Detroit—This month, the National Bank of Detroit will initiate Video Information Provider, an experimental home banking service that will use a simplified, low-cost videotex terminal requiring only a telephone and a TV set.

Such a system could overcome videotex's biggest stumbling block: that despite years of tests and a few recent product rollouts, widespread electronic delivery of such services as banking, bill paying, shopping, and information has so far failed to develop for the home market.

Costly. The problem is attributed to the high cost of the equipment—between \$500 and \$1,000 for a dedicated home videotex terminal—that consumers need to receive the services [*ElectronicsWeek*, July 23, 1984, p. 58]. Accordingly, many potential service providers have shifted their focus away from such systems and have concentrated instead on providing services to the growing base of home computer owners.

The cost of the NBD terminal is

low enough—about \$100 to the service provider—that it potentially could be supplied to the consumer at no charge. Revenues to support the service might instead be generated by a monthly consumer service charge or by per-transaction fees.

"We're also doing some tests with [services provided to] home computers and we don't want to rule that out," says James E. Lubinski, an assistant vice president and project manager in the bank's Systems Development Division. But he notes that the low cost and simplicity of the Tex terminal, supplied by four-year-old Telelogic Inc., Cambridge, Mass., was what attracted the bank to the system.

The Tex terminal's low cost is due to its reliance on the British Prestel videotex protocol and a system design that transfers much of the component and manufacturing cost from the terminal to the host computer portion of the system. Although it produces cruder graphics than the more elaborate North American Presentation Level Protocol Syntax (NAPLPS) standard, Prestel is easier and cheaper to implement.

The one-piece Tex terminal consists of a decoder, which translates the information transmitted from the host computer, and a radio-frequency modulator, which connects to a TV set's antenna leads for displaying the information on the screen. Although most phone-line videotex transmission systems provide two-way transmission of data, typically at 300 baud, the Tex terminal is actually a receive-only ASCII device, says Raymond C. Goff, Telelogic's manager of video systems research and development.

Tex receives frequency-shift-keyed data from the



Telelogic's Tex. A videotex terminal for the home ties into a modem at the host computer. Its low cost—around \$100—could spur activity in the home market.

host at a 1,200-baud rate. The user can indicate his choice of items from a menu on the screen and make other simple communications through the dual-tone multifrequency tones generated by the telephone keypad, but cannot actually send data as in a two-way system.

The Tex system "could go far in solving the [high-cost] terminal problem," maintains Steven B. Weissman, assistant publisher of *VideoPrint*, an

industry newsletter. Although a number of other banks, including Citicorp, Chemical Bank, and Bank of America, are currently running videotex home-banking tests, these systems typically aim to serve the home computer base, Weissman says.

"The low-cost terminal is a neat twist," Weissman observes. "The only way you're going to find out if it works is to try it."

NBD, the nation's 21st largest

bank, will test the system for 90 days with a group of about 100 customers before making a final decision. With Tex, customers will be able to transfer funds from one account to another, check balances and statements, and obtain information on stocks, interest rates, and other areas. The bank will maintain a data base of about 250 screens that will include sports scores, movie listings, and the like.

—Wesley R. Iversen

HOME COMPUTERS

Holiday season can't arrive too soon for beleaguered vendors

The pace of U.S. home computer sales has been as slow as Christmas lately, but there's a good reason. More than half the 5.5 million units expected to be shipped in 1984 are not likely to find a home until consumers wrap up their holiday gift buying in the fourth quarter.

Until then, U.S. software and hardware houses have but one wish: an end to the summer doldrums that many believe are now a way of business in consumer computer markets. However, some fear that the current slump in business—which surfaced in March—could become more than just a brief respite from the frenzy that drove world sales across the \$2.5 billion mark in 1983.

"Consumers are thinking about home computers a little differently this year. To be frank, the industry as a whole has had only its own interest at heart, and now we are all suffering a bit from that," suggests William Bowman, chairman of Spinaker Software Corp., of Cambridge, Mass., which sold \$11 million in home computer software last year. "What has to happen is a refocusing of efforts back to the needs of consumers."

New designs. The change in buying habits has touched off a flurry of hardware designs, which are now too late for 1984 introductions but which will likely result in a new wave of more-powerful models at the Consumer Electronics Show next January. Meanwhile, nearly all attention

is on loss-ridden Atari Inc. and new owner Jack Tramiel, the flamboyant former president of that company's archrival, Commodore International Ltd.

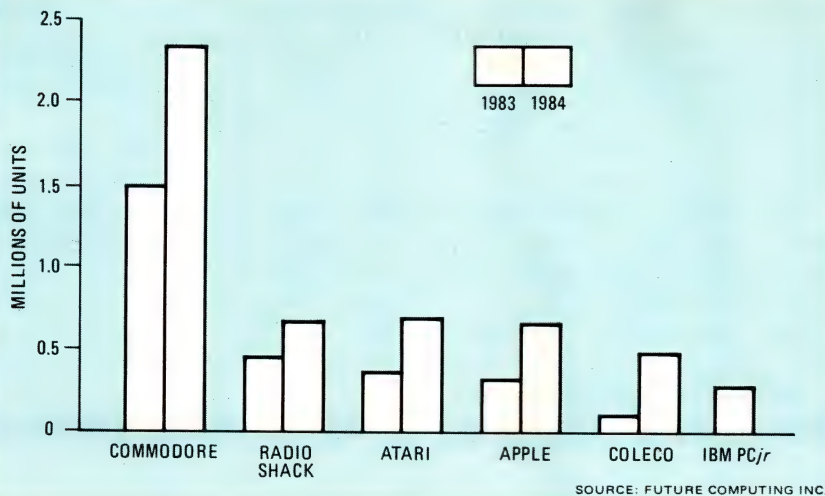
"Rumors about coming price wars and what Tramiel is up to are throwing up a tremendous smoke screen. All competitors can do is pick out whatever story they like best and wait three months when something is likely to be announced," says a representative at Atari's headquarters in Sunnyvale, Calif. Tramiel is promis-

ing a new Atari computer at January's CES. Software vendors are hoping that it will signal the promising new age of the second-generation home computer.

"There is a niche for hardware that has yet to be exploited, and that's a true high-end home computer," says David Evans, director of talent at Electronic Arts, the San Mateo, Calif., software supplier with a number of top-selling home computer packages. Evans, who previously worked for Apple Computer Inc.,



My turn. Home computers, such as the Commodore 64, continue to attract the attention of consumers of all sizes, but right now sales are in the summer doldrums.



says second-generation home computers are in development.

"They will be Macintosh-like with 16-bit processors, lots of high-resolution color graphics, disk drives, and containing at least 128-K bytes—if not 256-K—of memory," he states. Priced in the \$1,000 to \$1,500 range, the units will offer stiff competition to IBM Corp.'s PCjr and Apple's IIc personal computers, he adds.

Advanced machines. Market-leader Commodore is also planning to unveil new consoles at CES, according to James Dionne, vice president of sales and marketing at the firm's U.S. headquarters, in Wayne, Pa. "This fall, the only thing that will count is being able to ship products, and the only one that seems to be there is Commodore," says Dionne, who defines home computers as those consoles priced below \$500.

Commodore dominates the 1984 shipment volumes mostly on the

strength of its popular model 64, which has 64-K bytes of memory and sells for less than \$200. Many are now being sold with disk drives and other peripherals. To date, it has over 3 million in use worldwide. Commodore can reportedly produce 200,000 a month.

Dionne has seen no fall in sales and, like many other competitors, expects the firm to be sold out in the fourth quarter shopping season. In October, the firm will also begin selling a new "productivity" home computer—the Plus Four—which is slightly more expensive than the model 64 but contains more user-addressable memory. The Plus Four has four read-only-memory-based programs: word processing, spread sheet, data base management, and graphics.

Earlier this month, IBM Corp., Armonk, N.Y., gently repositioned its low-end PCjr personal computer

Lagging. IBM Corp. and Coleco Industries Inc. trail in the race for unit market share, although both companies have improved their home computer offerings.

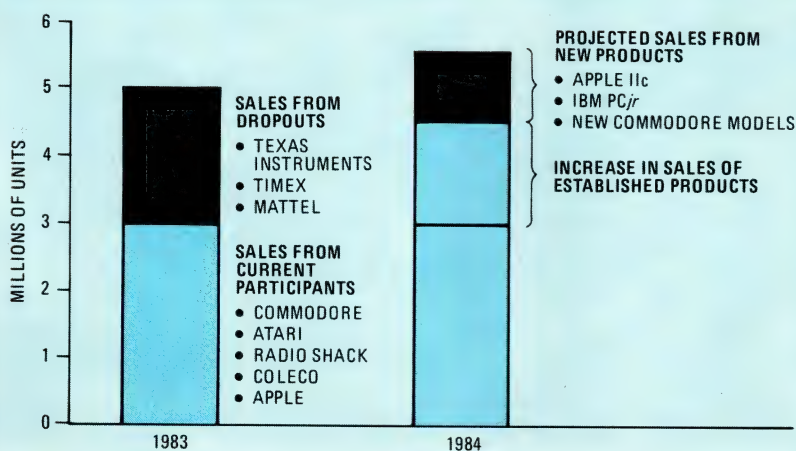
by unveiling a new keyboard and memory expansions aimed at improving sales in what is called the home-office market. Coleco Industries Inc., Hartford, Conn., is confident it has solved the problems that stalled sales of its Adam system last fall, says Al Kahn, executive vice president of marketing. Still, many observers of the home computer industry do not believe either will have a significant share of the all-important fourth quarter sales.

Last year's models. For the most part, increases in unit volumes will have to come from models that were on the shelf in 1983, says market-researcher Future Computing Inc. in Dallas. That worries many software vendors, which typically sell half their packages when newly introduced units are purchased.

"New participants have not come in at the low end of the market, mostly because they fear another bloodbath with Commodore," notes Future Computing analyst Paul Matteucci, citing the 1983 price war that saddled Texas Instruments Inc., Dallas, with \$660 million in losses. TI, which had 40% of the domestic market, pulled out of the business in October, dumping hundreds of thousands of its 99/4A units on the 1983 Christmas market.

Later, Timex Corp. and Mattel Inc. abandoned the loss-riddled market. The turmoil has been enough to keep most Japanese manufacturers out of U.S. markets (see "Japanese firms count on their home computer standard," opposite).

At the same time, projections of consumer software demand were bloated by buyers' reactions to TI's going-out-of-business sale, marketwide price cutting, and heavy television advertising throughout 1983. As a result, too many entrepreneurs launched software ventures, believing the market had turned into a year-round business. With software sales having taken a nosedive for half a



Newcomers. Established products in the home computer market should see good growth this year, but systems from new players will also sell well.

Japanese firms count on their home computer standard

Still waiting for the business to settle in the U.S., Japanese home computer manufacturers are focusing nearly all their 1984 efforts at cultivating steady sales in smaller but less volatile markets in their own country and Europe. All the 8-bit models are based on the emerging MSX operating system standard, created by Microsoft Corp., of Bellevue, Wash., and initially supported by 14 Japanese manufacturers [*Electronics*, June 30, 1983, p. 48].

Already, Sony Corp., Tokyo, and Sanyo Electric Co. Ltd., Osaka, have begun exporting home computers to the UK, while Matsushita Electric Industrial Co., Osaka, has begun sending samples there. The MSX standard is expanding geographically as well as technically, says Scott Oki, vice president of Microsoft's international activities.

MSX, created as a standard to run read-only-memory-based software, is now ready in a disk-operating-system version. Designed for use with 8-bit Z80 microprocessor hosts, MSX-DOS emulates CP/M-80 calls and contains MS-DOS file formats. "It's kind of the best of both worlds [8-bit Digital Research's CP/M and Microsoft's 16-bit MS-DOS]," says Oki.

In Japan, vendors have increased the memory capacity of MSX systems from 16-K bytes to 64-K bytes. Software is being built into machines, and a range of features is in the works to create several MSX segments, including a high end infringing on office automation markets.

Moreover, MSX is on its way across the world. "MSX is more than a Japanese standard. It can be called a world standard," claims Oki. "The list of firms backing MSX is growing almost daily—three Korean companies have licensed it as well as Philips in Europe." In addition, Microsoft is negotiating with more European firms along with a few in Brazil, he says.

"In the U.S., we have been in contact with a couple of American companies—one now in the market and another seeking entry," he explains. "It looks pretty good and could

bear fruit." Most established U.S. hardware manufacturers, however, are stonewalling any efforts to create an American home computer software standard, fearing it would open the door for foreign competitors.

But Japanese manufacturers believe the biggest problem with U.S. markets is not software. It is the low margins resulting from 1983 price wars between Texas Instruments Inc. and Commodore International. Yoshihiro Sato, manager of the personal computer marketing division at Fujitsu Ltd., Tokyo, says U.S. home computer markets remain unattractive in 1984, with only slim profits at great risks. Instead, Fujitsu will compete in the U.S. business markets with its recently introduced 16SX personal computer.

NEC Corp., Tokyo, which does not support the MSX operating system, also has no intention of getting involved in cut-throat competition, says Shunzo Hamada, general manager of the personal computer marketing and promotion division. NEC has shipped limited numbers of its low-end PC-6000 to the U.S., but it's now competing in business markets with its 8200 briefcase computer and APC 3, a 16-bit computer.

MSX units from Japan, however, are expected to finally appear at U.S. trade shows early in 1985. The manager of Matsushita's personal computer department, Kazuyasu Maeda, expects his firm to begin shipping MSX units to the U.S. next year.

Japanese manufacturers shipped 250,000 MSX computers in Japan by the end of June, Maeda estimates. He believes 500,000 of the projected 1.5 million personal computers shipped in Japan this year will be MSX systems. Already about 500 MSX software titles are on the market, and the total is expected to double by year's end. Today, 70% of all Japanese personal computers shipped are finding their way into the home, says NEC's Hamada. Just as in the U.S., games account for the majority of software used on Japanese home computers.

year, weaker competitors are expected to close up shop by the first quarter 1985.

"I am not calling it a glut, but there has been a dramatic increase in both the number of publishers and titles, based on the optimistic projections of last year," says Fred Cutler, general manager of the consumer products division at Digital Research Inc., Pacific Grove, Calif., which is marketing the Personal CP/M operating system for the home market. "And I do not think we will see any more home computers being sold than people thought last year."

The fundamental problem is over-reliance on price cuts as the chief means of spurring business, Cutler warns. "Perhaps if Jack Tramiel really does drive prices down to \$175 on Atari's 800XL and Commodore re-

sponds, it will give us a little pop in market sales. But that is not addressing the much broader concern of why do we need a computer in the home.

"So you end up with more people buying low-end computers to see what home computing is all about. They get dissatisfied once they begin to use them, and that will cause an even bigger problem next year when they ask once again, 'Why do we need a home computer?'"

More growth. Still, the market is expected to continue its growth. Info Corp., Cupertino, Calif., places 1984 world sales of computers retailing for less than \$1,000 at \$4.3 billion, rising to \$7.1 billion in 1985.

Home computers are not headed for the same future as video-game machines, assures Fred Shimp, senior

buyer of consumer electronics at K Mart Corp., in Troy, Mich., which sells Commodore and Atari products. He thinks Tramiel's takeover of Atari and aggressive marketing will stimulate consumer awareness in the pivotal Christmas season.

Tandy Corp., Fort Worth, Texas, ranked by many as a distant second behind Commodore, is selling three times as many of its Radio Shack Color Computers as it was a year ago, says Ed Juge, director of market planning.

The home market, he says, is sharply divided into two segments—the low-end machines priced below \$300, and units priced around \$1,200. The 6809-based Color Computer sells for \$160 for 16-K of memory and the standard Basic programming language. At present, Juge

sees no need for a midrange home computer, an area troubling Spinnaker's Bowman. "We think we are missing 40% of the software sales without a midrange computer [priced between the \$300 and \$1,000 units]," Bowman says.

Home-entertainment software producer Activision Inc., of Mountain View, Calif., see hardware sales falling by as much as 30% from last year's pace, but it also expects to see some new life this fall. In September, the firm will ship its first game packages for the emerging MSX machine standard to Japan and European markets.

—J. Robert Lineback

COMPUTERS

IBM-EC accord: who benefits?

Brussels—Most European computer-industry executives are wondering whether anyone other than the defendant will benefit from the suspension of the unfair practices suit against IBM Corp. by the Commission of the European Communities.

The result of the settlement of the case [*ElectronicsWeek*, July 30, 1984,

p.15] is that European manufacturers wanting to take advantage of the concessions exacted from the Armonk, N.Y., firm would have to change the nature of their business more markedly than IBM would. "They [the EC commissioners] simply didn't go far enough," laments the managing director of a major European computer manufacturer, who requests anonymity. "There's just no way I can see that this will benefit mainstream European equipment manufacturers."

The most likely to benefit from the decision are manufacturers of IBM-compatible peripheral equipment that have production or research and development activities in a Common Market country. At the moment, only West Germany's Nixdorf clearly falls into this category.

Other European companies wanting to take full advantage of the arrangement would, quite simply, have to make a decision to get into the IBM-compatible business. In Europe, as in the rest of the world, this business is dominated by such Japanese firms as Fujitsu and Hitachi, which carry out their computer research and production in Japan.

The 12-year-old case revolved around an accusation that IBM has abused its dominant position in the European market. The essence of the Commission's objection was that

IBM would announce new mainframe computers but not publish the interface information essential to competing suppliers of software and peripheral equipment until it had begun delivering them.

As development of such equipment is a time-consuming process, IBM virtually locked up the peripherals and software market for its new mainframes for as much as several years. This situation, contends the EC, violates the Treaty of Rome, which is the basis of the Common Market. The commission was thus prepared to levy a heavy fine on the U.S. company in addition to ordering it to publish interface information at the same time that it announces its new products.

Suspended. In what amounts to a compromise on its previous demands, the Commission has agreed to suspend its action against IBM until at least 1990. In exchange, IBM committed itself to a number of undertakings, the most vital of which is IBM's agreement to release interface information within four months of product announcements. IBM is already beginning to do so (see "IBM unveils System/370 interface data," below). The EC claims that this will foster more competition in the European market.

"IBM is now willing to give out information that will enable competitors to really compete," asserts Frans Andriessen, the EC commissioner responsible for competition. "A substantial change is going to come about in IBM's business practices. This will make it possible for an improved competitive situation."

Most industry observers are skeptical. "What IBM is giving away [in the settlement] is absolutely nothing of value," argues one Paris-based data-processing industry consultant. "The agreement is really very little more than window dressing."

"For starters, IBM already releases all of the information required by the undertaking, so what we're talking about is a question of timing," he explains. "And with European manufacturers already turning their energy toward the establishment of the OSI [open systems interconnection] standard, it's difficult to believe that they're going to jump on the IBM-compatible bandwagon."

Still, some industry executives

IBM unveils System/370 interface data

To persuade the Commission of the European Communities to suspend the unfair practices suit against it, IBM agreed to give its EC competitors information about its System/370 and successors, which reportedly account for some 80% of its European business. IBM commands nearly 40% of the European data-processing market. In its undertakings, IBM essentially agreed:

- To make available to competitors information about interfaces between System/370 equipment and software within 120 days of relevant product announcements. Software interfaces are to be issued as soon as they are technically proven, although no later than when they are put on sale.
- To interpret "interface information" as meaning a description "sufficient to enable a competent professional skilled in the art to attach a product of his design to an IBM System/370 product."
- To announce in the EEC all new System/370 products intended for sale there as soon as they are launched anywhere in the world.
- To disclose details of any products that represent technical enhancements of Systems Network Architecture, as well as those related to the 43XX, 303X and 308X mainframe computers. Excluded from the accord are smaller computers such as Series/1, 8100, systems 36 and 38, and the IBM Personal Computer line.
- To offer the System/370 mainframe processors in the EC without main memory installed.

—Robert T. Gallagher

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TI's new memory

125 MHz pixel-rate performance. With memory parts count cut by 75%. And cost savings more than 50%. The unique TMS4416 16K $\times$ 4 DRAM from Texas Instruments is the first 64K dynamic random-access memory (DRAM) in the world that could provide this performance at that price. And that's why it was chosen for the new, advanced Tektronix 4115B Computer Display Terminal.

Designed for the most demanding CAD/CAM applications, the Tektronix 4115B features a high-resolution color raster-scan display. This 60-Hz, non-interlaced, flicker-free display provides resolution of 1280 $\times$ 1024 pixels. Up to 256 colors can be displayed at one time from its palette of 16 million colors!

System-wide cost savings

By upgrading from four 16K devices per single in-line package to one TMS4416 ByFour™ DRAM (see photo), Tektronix cut costs by more than 50% and memory parts count by four times.

System costs also were lowered, due to fewer interconnects and support circuits. This reduced inventory, cut power requirements, and enhanced reliability.

Lower power, higher reliability

With one 5-V power supply at 130 mW per 64K, the TMS4416 significantly cut power consumption. This increased power supply margins and reduced noise. Plus, lower heat dissipation and fewer interconnects improved system reliability.

Equally important, TI met Tektronix's critical delivery schedule.

Meets many design needs

Where can the TMS4416 help you? In personal and small business computers. Intelligent terminals requiring 16K- and 32K-byte memory modularity. Single-board microcomputers. And more.

The output/enable feature makes interfacing the TMS4416 with micro-processors simple. ■

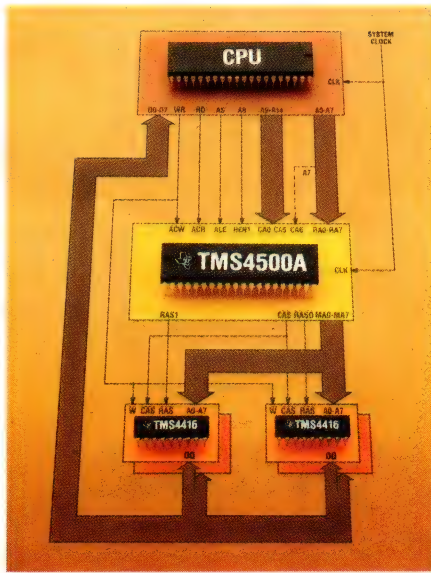
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◀ **An exceptionally "clean solution,"** TI's TMS4416 16K $\times$ 4 DRAM enabled Tektronix to reduce memory component count by four in its new 4115B Computer Display Terminal. Each TMS4416 replaced four 16K devices mounted on a single in-line package.

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16K x 4 DRAM cuts costs by 50% for Tektronix.



For a cost-effective, low-power memory system that uses minimum board space, combine the TMS4416 or the TMS4164 64K DRAM with the TMS4500A.

One TI chip links DRAMs with CPUs.

TI's TMS4500A DRAM controller saves design time and IC costs.

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TI's 64K DRAM chip carrier: More memory in less space.

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Two outstanding choices in TI 64K DRAMs

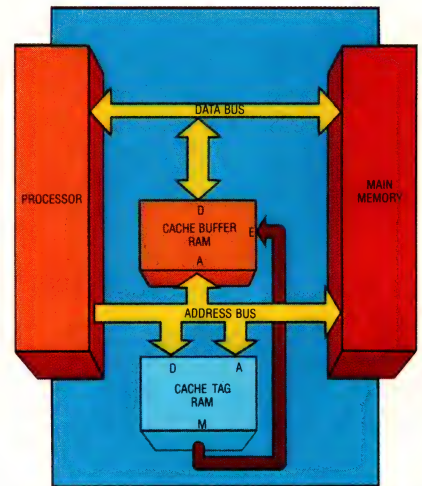
When you need 64K DRAMs, rely on TI's outstanding choices. The TMS4164 for high speed, low power, and chip carrier packaging. The TMS4416 for high bandwidth and modularity. Both are cost-efficient. Easy to design with. And state of the art.

New cache-tag comparator speeds system throughput.

TI's new TMS2150 cache-address comparator can improve high-performance microprocessor or bit-slice system throughput by up to three times. Plus reduce cache memory IC count, board area, power dissipation, and cost.

With the TMS2150, no wait states need to be implemented in microprocessor access cycles in response to slower cycling DRAMs. The TMS2150, in combination with high-speed static RAMs, completes an entire high-performance cache memory system. With a maximum 45-ns delay from address to match valid, the TMS2150 can provide TTL performance at one-tenth the parts count and 10% of the power.

Operating from a single +5-V power supply, the TMS2150 consists of a high-speed 512 x 9 static RAM array, parity generator and checker, and a 9-bit high-speed comparator.

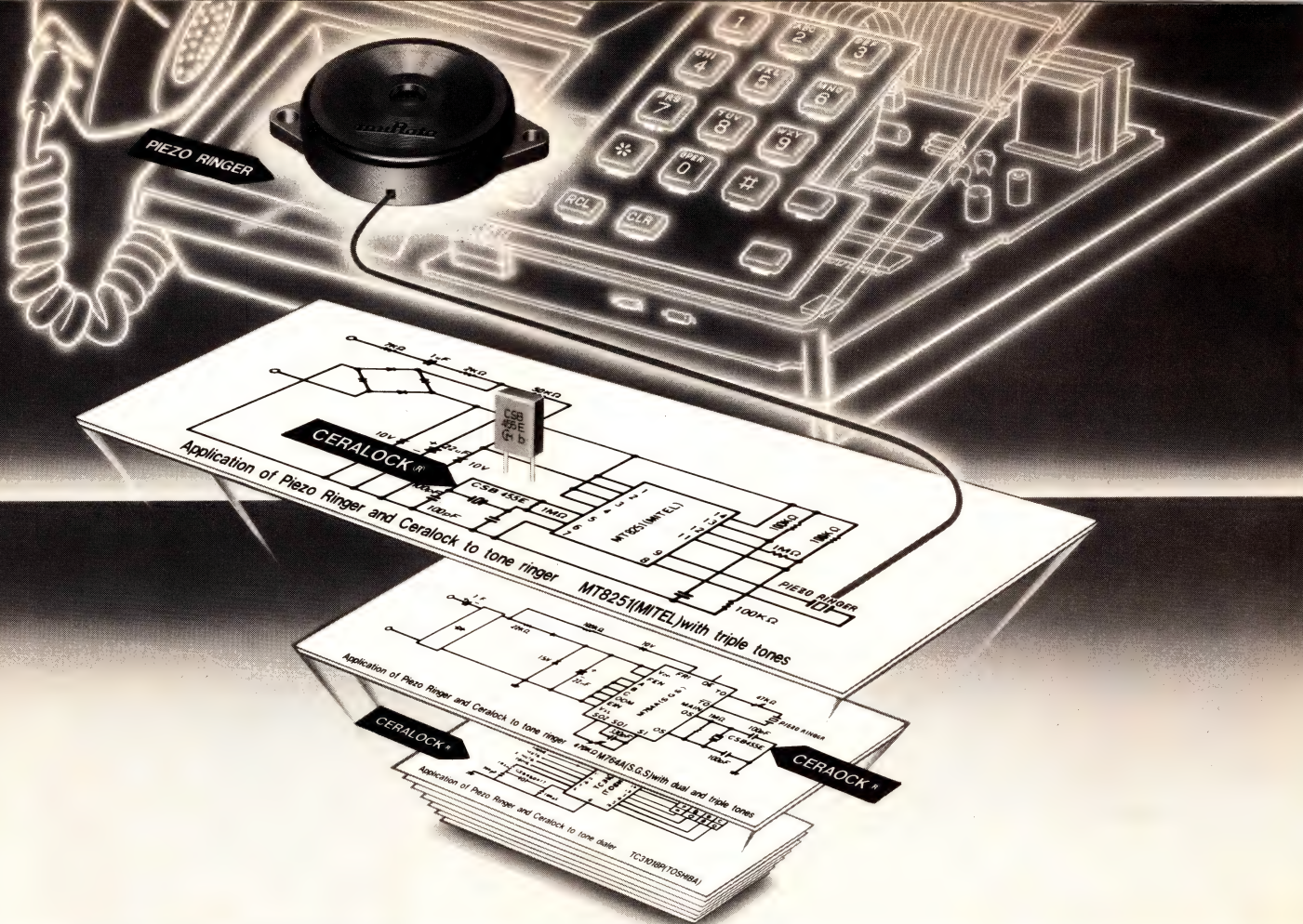


High-speed cache memory systems utilizing the TMS2150 will enable high-performance microprocessors to set new cost-performance standards with large, low-cost dynamic main memory.

For more information on TI's high-quality 64K DRAMs, DRAM controller, cache-tag comparator, and plastic chip carrier, call the authorized TI distributor nearest you. Or contact Texas Instruments Incorporated, Dept. SMB023EC, P.O. Box 809066, Dallas, TX 75380-9066.

Circle 22 on reader service card

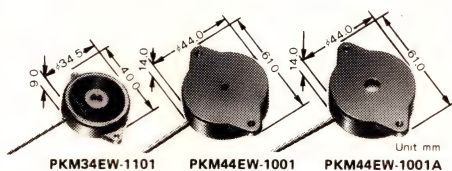
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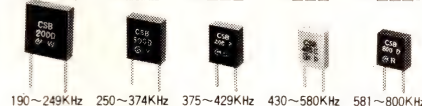


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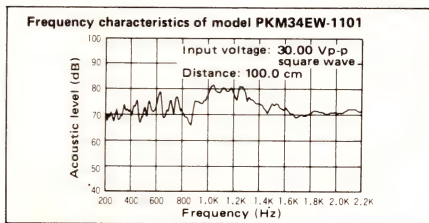
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Car Telephone	●	●	●	●	●	●	●	●	●	●	●	●	●
Cordless Telephone	●	●	●	●	●	●	●	●	●	●	●	●	●



Specifications of model PKM34EW-1101

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Circle 83 on reader service card

point to the fact that this is the first time that IBM has admitted an obligation to make available interface information, as well as committing itself to a timetable for such disclosure. Perhaps more important, IBM has acknowledged, also for the first time, that it supports OSI as the world standard for connecting computer systems.

Christopher Wilkinson, head of the EC's task force for information technology, is confident that OSI now has a far better chance for adoption as the industry standard than IBM's System Network Architecture. "The European Community will continue to pursue OSI standards for telecommunications and information technologies in the community," he says. "We are reassured that IBM has stated it will participate."

"SNA is not a standard. Were SNA to extend beyond the market leader to companies at large, then SNA would have to enter the public domain." But in practice, Wilkinson thinks that SNA will progressively give up ground because it is not the latest technological concept, and that since OSI is much more modern and adapted to distributed processing, it will gradually replace SNA.

Several months ago, in what most observers saw as a move aimed at countering the adoption of SNA as a *de facto* standard, the principal European computer manufacturers agreed to work together in order to foster the adoption of OSI as the industry standard [*Electronics*, March 22, 1984, p. 63]. —Robert T. Gallagher

DATA NETWORKS

IBM joint venture to test EC accord

London—The litigious clouds that have long hung over IBM Corp.'s European activities may have cleared just in time to get a proposed joint venture with British Telecom off to a flying start. The two monoliths want to set up a network management service in the UK, using British Telecom's communications hardware and know-how and IBM's proprietary



Bridge builder. British Telecom's Ronald Back insists the joint network proposed by BT and IBM will have bridges to both IBM's SNA architecture and the ISO's OSI protocols.

Systems Network Architecture.

British Telecom says it is still committed to following the International Organization for Standardization's open-systems interconnection (OSI) model for public packet-switched services and plans to provide gateways between OSI systems and SNA nets. However, many people in the data communications business nonetheless are concerned that the joint company would dominate the nascent value-added-network (VAN) market and establish SNA as a *de facto* standard.

Now, Norman Tebbit, the Trade and Industry minister, has asked for industry comment before he decides in September whether or not to grant the venture a license. IBM's newfound willingness to make life easier for competitors wanting to attach to SNA—outlined in its settlement with the Commission of the European Communities—will weigh in the Armonk, N.Y., firm's favor.

The plans outlined by British Telecom and IBM UK Ltd. call for both network management and value-added services. In such a network, intelligent computers handle security and access control, plus fault recovery and administration, all the time gathering network loading statistics and allocating costs. VANs provide electronic mail and computer data-base links for use in insurance, banking, retailing, and the like.

Aside from British Telecom and IBM, Britain's ICL plc has been lay-

ing plans for the VAN market in collaboration with AT&T Co. AT&T will supply packet-switching equipment, protocol processors, and a bi-directional gateway to NET 1000, AT&T's own U.S. network. ICL's first customer, the Article Number Association, will use the network for the exchange of orders, invoices, credit, and delivery notes between retailers and suppliers in the UK.

IBM and British Telecom, meanwhile, have an inside track on an electronic-funds-transfer point-of-sale service being contemplated by 20 of the City of London's largest banks, banded together in the Committee of London Clearing Banks.

Competition shaken. ICL and other manufacturers fear that they would very quickly be swamped by the combined market power of IBM and British Telecom. British Telecom is attempting to reassure them by promising that its packet-switched data network will take on OSI standards as they are ratified. Also, it says it will work with IBM to provide bridges between the two types of nets.

Says Ronald Back, managing director of British Telecom's Network Services, "Our plan for the future is rooted in the firm belief that there should, in the end, be just one set of standards . . . but it is still a long way off. In the meantime, we have to cater for the needs of our customers who are geared to existing protocols."

British Telecom's success in bridging the two networks now depends on how IBM interprets its limited agreement with the EC (see story, p. 20). "IBM recognizes—and favors—the widespread interest in interconnecting systems and networks of different manufacturers and will publish extensive information about it, including formats and protocols which facilitate attachment by competitors of their systems or networks to IBM SNA networks," it says.

Also, IBM, in a step to counter charges that SNA's hierarchic structure leaves network control very much in its control, has agreed to make network diagnostic programs accessible to attached equipment.

Britain's ICL thinks the accord leaves loopholes, as it can take two years for competitors to implement changes in their own products suffi-

cient to interwork with IBM's. ICL's view is that interface information should be released no later than the time of its announcement, rather than shipment. —Kevin Smith

VLSI TESTING

Design programs aid IC testability

Princeton, N.J.—As digital very large-scale integrated circuits increase in density and complexity, the cost of testing them rises exponentially. One of the most promising solutions to the expense of VLSI testing is called design for testability, or DFT: design methods, procedures, and rules which, when applied, result in circuits that are substantially easier to test.

DFT can radically decrease the cost of testing, but because it requires additional on-chip test circuitry, it does not come cheaply. The question becomes how much DFT is necessary for each VLSI design.

Siemens Corporate Research and Support Inc.'s Research and Technology Laboratories, Princeton, N.J., have developed an experimental system called IDAS (for Integrated Design for Testability and Automatic Test Generation System) that answers that question and does quite a bit more.

IDAS is built around a Daisy Systems Corp. work station and a group of specialized software programs that perform testability analysis, a prediction of test cost, automatic testability, and optimization of the test pattern for the modified IC design.

The elements of the IDAS system include:

- CADAT, a logic and concurrent fault simulator.
- HECTOR, a heuristic controllability/observability tree-search program for testability analysis.
- ATWIG, an automatic test-pattern generator with inherent guidance for combinational and sequential digital circuits that is based on the HECTOR testability analysis.
- PRETEST, a program that predicts the total cost of ATWIG.

■ EDIT, a number of programs for evaluation, display, and improvement of testability that assist the designer through graphical representations to isolate testability problems in a circuit and to identify the causes of potential problems. One of these programs also automatically selects the flip-flops to be included in an incomplete scan path (see "Incomplete scan path saves silicon," below) for a given circuit.

IDAS provides the designer with immediate access to test-design tools with minimal human interaction. In addition, an interactive environment enhanced by graphical feedback from the analysis tools is provided to improve testability.

In actual practice, an engineer de-

signs a digital IC at the Daisy work station. From there he sends the design to a data base containing CADAT, HECTOR, PRETEST, EDIT, and ATWIG, which are all resident in a Digital Equipment Corp. VAX 11/780 or some other large computer.

By typing a suitable command on his work station, the designer feeds a CADAT logic simulation of his circuit into the HECTOR testability analysis program. HECTOR's output is then given to PRETEST for calculation of the circuit's test coverage. If the test coverage is below a certain design objective, the information from HECTOR is fed into EDIT, which suggests how to increase testability. The designer can

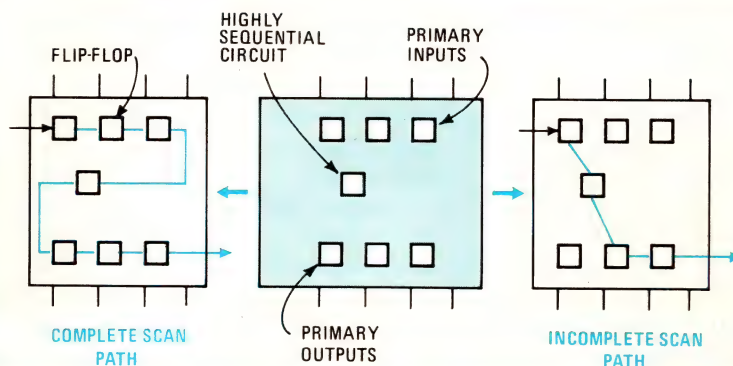
Incomplete scan path saves silicon

A well-known design for testability technique is IBM's level-sensitive scan design [*Electronics*, March 10, 1983, p. 110]. LSSD involves a scan path in which all the flip-flops in a circuit are connected to form a shift register. The technique's main disadvantage is that it requires a significant amount of additional on-chip circuitry in the pattern generator. In 1983, Erwin Trischler of Siemens Research and Technology Laboratories, in Princeton, N.J., developed a method of on-chip testing called the incomplete scan path. As the figure shows, not all the flip-flops are included in the incomplete scan path. Of course, it is not always easy for a designer to choose what gates to include in the testability analysis. With IDAS, however, the combination of HECTOR and EDIT helps to optimize the selection.

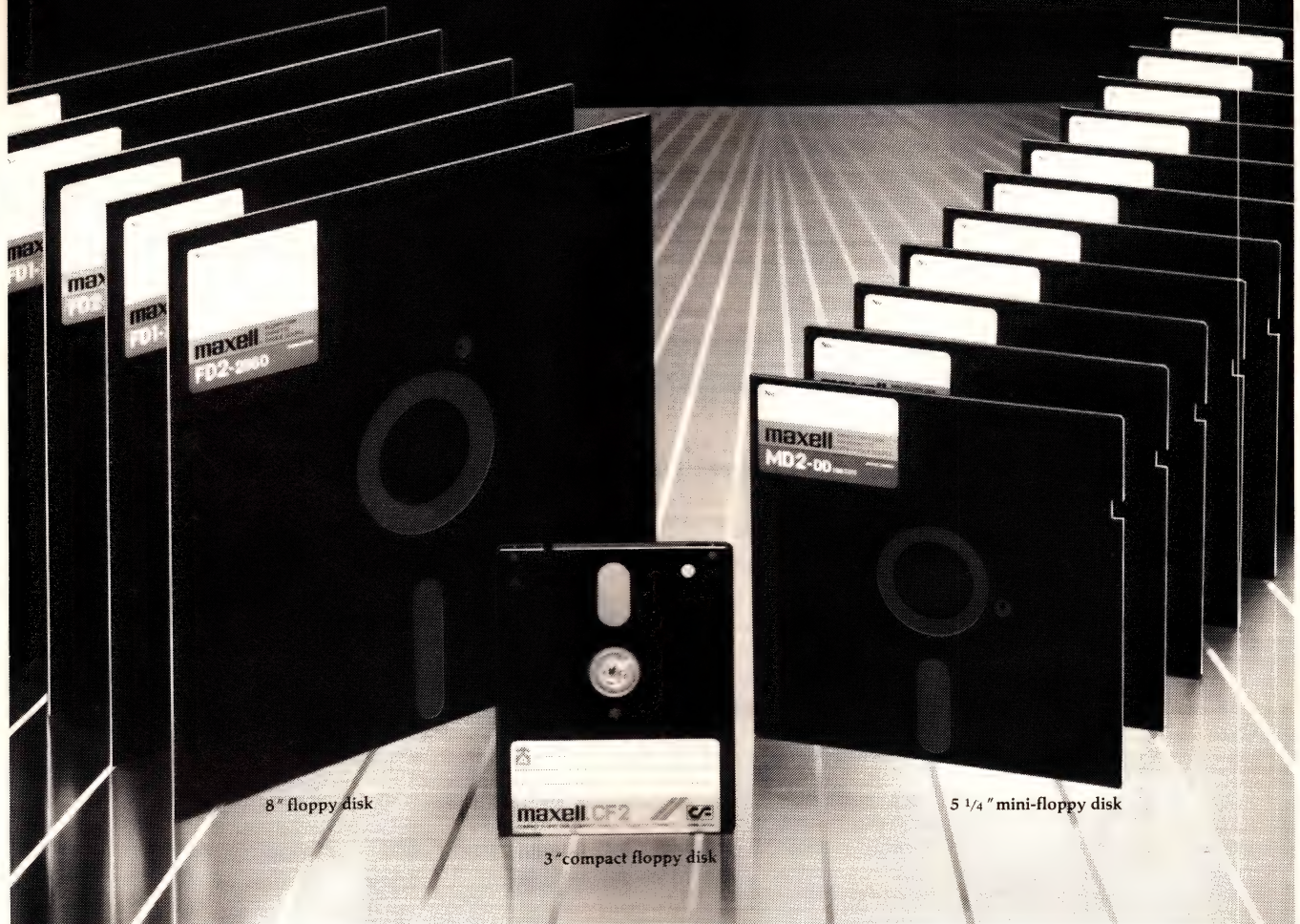
Comparison tests of both incomplete and complete scan paths were run at Siemens using emitter-coupled-logic master-slice chips having between 350 and 650 gates. The results showed that the complete scan path allows the greatest reduction in the costs of automatic pattern generation but has the highest additional hardware overhead. The incomplete scan path has slightly higher hardware costs than conventional test methods.

If the original circuit is difficult to test and the necessary pattern generator requires a relatively high amount of processing time, the greatest incremental cost reduction can be achieved by including between 15% and 30% of the most-difficult-to-test flip-flops in an incomplete scan path. All in all, the results show that the selection of flip-flops based on testability is a valuable approach, especially if the additional hardware overhead is low.

—Jerry Lyman



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then modify the circuit on his work station, possibly adding more test points, incomplete scan-path circuitry, or full scan-path circuitry. The modified circuit is fed down the software path again. If EDIT has a satisfactory result, the new HEC-TOR data is fed into ATWIG. The resulting pattern is tested for fault coverage against a CADAT fault simulation. If satisfactory, this same

pattern can later be used for actual chip testing.

Currently, IDAS can test a circuit with as many as 10,000 nodes. All initial work that was done with IDAS involved emitter-coupled-logic circuitry, but Siemens has a complementary-MOS capability in the works. A cycle for typical 600- to 1,000-gate ECL designs have taken less than 5 min. —Jerry Lyman.

COMPUTER-AIDED DESIGN

Silicon compiler and wafer ICs teamed for signal processing

Edinburgh, Scotland—Tomorrow's systems designers will likely use silicon compilers to turn systems specifications into very large-scale integrated circuits automatically, and they may also use wafer-scale ICs in place of printed-circuit boards and custom chips. That, at least, is the view of researchers at Edinburgh University, where a project to develop a silicon compiler for signal processing circuits will shortly be extended to take on wafer-scale ICs (see "Signal processing on a wafer-scale IC," right).

Regardless of how Edinburgh's wafer-scale project works out, chip designs automatically generated from a brief functional description are just around the corner [*Electronics*, May 3, 1984, p. 121]. Several companies are working on design synthesis, including IBM Corp. [*Electronics*, May 17, 1984, p. 97].

Second opinion. Another company working on silicon compilers is Silicon Design Labs Inc., in Basking Ridge, N.J. [*Electronics*, June 28, 1984, p. 14]. Misha Buric, a founder of the company, says that the design of the Edinburgh machine has its limitations.

"It was designed specifically for bit-serial processing architecture and can be used only with signal-processing tasks," he says. "In our case, we are more flexible in terms of architecture. We are not limiting the designer to a particular architecture."

Peter B. Denyer and David Renshaw, of the Department of Electri-

cal Engineering, and Neil Bergmann, of the Department of Computer Science, first described such a silicon compiler in 1982 [*Electronics*, July 28, 1982, p. 68]. It aroused industry interest but was then unproven. Now it has a track record and has been shown to work.

Silicon compilers can be used by a systems designer with no experience in designing VLSI chips in order to turn around chip designs quickly and

cheaply, as well as to produce a first-time-right, error-free design. Using Edinburgh's compiler, for example, one designer with no previous experience of IC design, produced a 16,000-transistor system in just four weeks.

His five-chip set replaces a system containing 160 TTL parts with a power consumption of 10 W. This TTL version took six months to design and debug. The chip set is for use as a fast equalizer in a modem polling setup, but could just as easily have been used in a linear-predictive-coding system for speech synthesis, or as part of a spectral analysis system.

Other chips designed with First (for fast implementation of real-time signal transforms) for academic applications include a variety of finite-impulse-response filters, adaptive echo cancellers, and both parallel and pipelined fast-Fourier-transform engines.

It was not always thus. Renshaw, speaking at a recent workshop on silicon compilation organized by Edinburgh University's Department of Computer Science, says the compiler was not suitable for industry at first.

To begin with, First was implemented on a dated 5- μ m n-MOS

Signal processing on a wafer-scale IC

The bit-serial architecture used by Edinburgh University as the basis for its First silicon compiler is a candidate for wafer-scale integrated circuits, a possibility that Peter Denyer and David Renshaw of the Department of Electrical Engineering are planning to investigate. Their basic idea is that redundant signal-processing cells be incorporated in a wafer-scale design together with self-testing and switching logic that will connect healthy cells in place of faulty ones.

The rudimentary architecture has yet to be determined and will depend on an initial yield study. But other elements in the design—such as the on-chip test circuitry, which they also plan to use in conventional chips—have already been worked out and add little or no extra overhead.

All that is needed is simple register and control logic incorporated into the chip's input/output pads. The circuitry at the input is used as a pseudo-random number generator to produce a test pattern 1-K in length, while the register logic at the output performs a signature analysis to check the chip response against a known-good chip. The technique, described at the 1983 International Test Conference in Philadelphia, can be applied at the chip, subsystem, and system level and is an essential feature of any wafer-scale system. The bit-serial communications system also means that redundant cells could be wired in to replace faulty ones without too great an overhead. Significantly, a bit-serial structure is also the basis of the wafer-scale project now starting at Sinclair Research Ltd., Cambridge, though there the principal aim may be to produce a cheap and compact solid-state replacement for Winchester and floppy-disk memories.

—Kevin Smith

Software environment. The software support for the First system consists of a small suite of programs providing the designer with a complete, specialized design environment.

process. But now, Denyer and Renshaw have designed a full library of 3- μ m complementary-MOS cells and will be describing them in a paper to be presented at the Tenth European Solid-State Circuits Conference to be held in Edinburgh from September 19 to 21. The CMOS-based library may deliver VLSI chips of sufficient complexity to interest industry.

Also, First software now runs on Digital Equipment Corp. VAX 11/750 hardware running under Unix. Added front-end software tailors First to an application. For example, the specifications of a ladder filter need only be entered into the front-end compiler and First will generate a suitable chip design automatically.

Also new is a graphics display output facility that will generate output waveform simulations so a user can check his design. Now, says Renshaw, the university is looking for ways to commercialize First.

First is based on the use of a novel bit-serial architecture. It compiles a circuit from a library of simple bit-serial cells such as multipliers, adders, and delayers, which it connects into a network or flow graph.

The design is hierarchical so a user may call and connect four multipliers, an adder, and a subtractor to create a complex multiplier that becomes a new system operator to be called as required. Throughout this hierarchy of primitives, operators, chips, subsystems and systems, communication is by simple and easily partitioned bit-serial links.

During chip layout, First works to a fixed floor plan placing cell functions on either side of a central communications channel or core. Primitives are then wired up through the communications channel.

The core does not monopolize the chip area, as might be the case with bit-parallel architectures, because bit-

serial signals occupy a single wire. After bonding pads, clocks, and power supply lines are added, the chip is complete.

First also supports a system simulator for debugging the system description. The simulator runs from the same high-level system descrip-

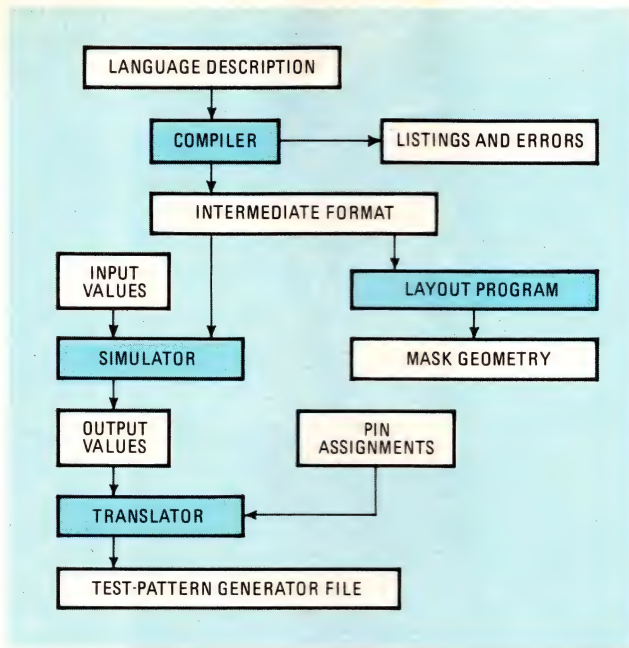
tion file that is used by the compiler. This last stage completes the design loop and delivers an error-free system implementation.

There are two distinct compiler developments at Edinburgh, one of them a gate array compiler developed by Lattice Logic Ltd. in Edinburgh and adopted by Ferranti Electronics Ltd., Oldham, Lancs., VLSI Technology Inc. in San Jose, Calif., and by the Swiss Fela Group of Companies.

The other package is the First compiler for signal-processing circuits. There are major differences between the two, though both groups of developers work closely together.

The Lattice Logic compiler works from a completed logic diagram. The First compiler works from a simple functional description of the required circuit and thus captures or takes in virtually the entire design process—not just translating it into an IC design.

—Kevin Smith



DISTRIBUTION

Maverick vendor of Japanese ICs stirs controversy over practices

Los Angeles—Although relatively unknown outside U.S. component purchasing circles, CAL-ABCO, a distributor of Japanese integrated circuits, stirs up some strong opinions. The privately owned company has achieved meteoric growth since early 1983—with sales now approaching \$100 million—in a manner that causes controversy in the tightly knit distribution community.

The company has been able to obtain a continuous supply of nearly impossible-to-get memory and processor parts, and to deliver them quickly, but at premium prices—triple the normal prices for random-access memories and even more for the short-supply low-power Schottky TTL chips needed for personal computers. This practice has evoked

charges that the parts originated in the "gray market," in which parts move in an unconventional manner between manufacturer, distributor, and customer. Gray markets usually exist when parts and products are in short supply.

Moreover, as today's supply-and-demand situation for components has come more nearly into balance, the firm just as aggressively is seeking further expansion by undercutting prices, primarily in memory products. For example, during the industry's recent parts shortage, CAL-ABCO was selling the 6116 2-K-by-8-bit complementary-MOS RAM for \$12.50, versus about \$5.45 charged by other U.S. distributors. Now, it is offering the same part at \$4.50 while others are charging \$5. Large-quantity



Confident. The semiconductor industry "has turned into a true global marketplace, where world supply can be balanced with U.S. demand," says CAL-ABCO's Alex Sandel (right), who founded a firm with Benny Alagam and Jason Barzalay to take advantage of the situation.

ty buyers jump for this deal, although smaller ones say the saving is not significant.

The fact that CAL-ABCO does not follow the time-tested business methods of other U.S. distributors is indeed fundamental to the firm's basic operating plan, according to the principals. "We don't want to be seen in that mold," says Alex Sandel, president. Along with fellow Israelites Jason Barzalay and Benny Alagam, he formed the company in January 1983, out of two firms already in the business.

Major changes. The rationale for CAL-ABCO is based on major changes in the semiconductor industry since the late 1970s: "It has turned into a true global marketplace, where world supply can be balanced with U.S. demand," Sandel says. In his view, understanding of "this global-marketplace reality" has lagged to the extent that CAL-ABCO could step into it and grow so fast before competitors could catch on.

The keystone, of course, is getting Japanese ICs, and the firm maintains a 15-person Tokyo office to assure a supply. What is little understood even by many insiders is that Japanese manufacturers have surpluses available; production runs undertaken for domestic customers often ex-

ceed what is eventually needed.

CAL-ABCO buys these on a regular basis and also does much business with the giant Japanese trading firms, which handle semiconductors much as they would any other commodity. Sandel picked up the initial idea for doing business in this manner when he was Far Eastern manager for the Microelectronics Division of Rockwell Corp. in the mid-1970s.

Getting along. As for relations with the Japanese semiconductor firms, "some of them love us" for taking the leftovers without fanfare, claims Sandel. "For the same reason, their U.S. rep firms hate us."

It is Sandel's contention that Japanese semiconductor management officials generally are not comfortable with the U.S. distribution or representative system, since it does not exist in a similar form in their home country. The concept of the stocking distributor, in fact, is alien to Japanese efficiency techniques, which emphasize just-in-time delivery of parts directly from the manufacturer.

CAL-ABCO ships its ICs from the Tokyo office to a central warehouse in Van Nuys, from which it supplies six U.S. branches within days after getting government approvals. The company plans to move into a new facility with triple the space at near-by Woodland Hills by September



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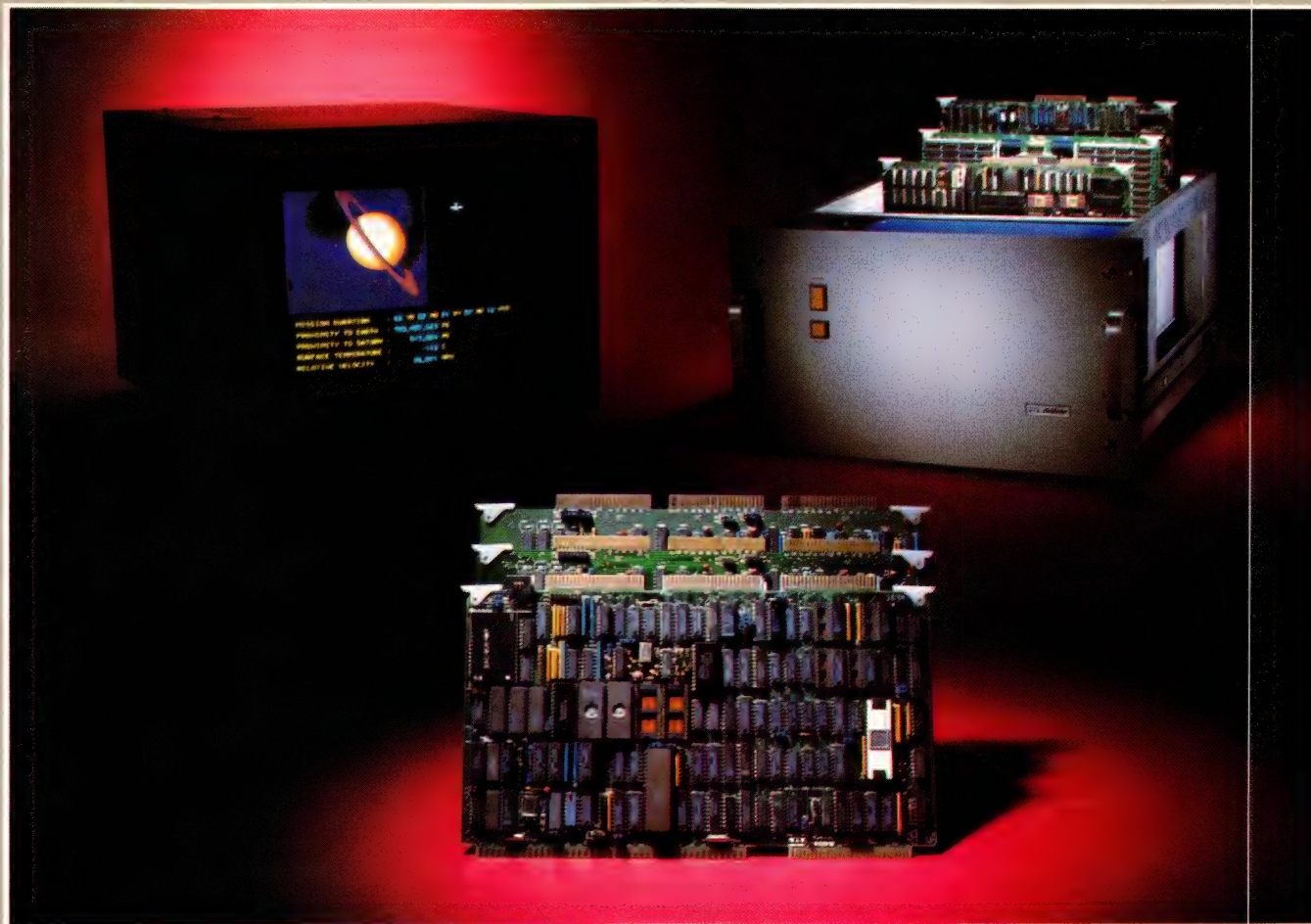
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and will add 12 more regional U.S. offices by year-end, Sandel says.

It stocks about 400,000 parts, worth approximately \$20 million from such manufacturers as NEC Corp., Oki Electric, Toshiba Corp., Hitachi Ltd. and Mitsubishi Electric. The firm stresses immediate delivery of orders as large as 50,000 pieces. "That's our livelihood," says Sandel, "or why else come to a distributor?"

As might be expected, skepticism abounds about the continued prosperity of CAL-ABCO during a period when parts are available through established channels. In this camp is Benjamin K. Sharfi, president and founder of General Micro Systems Inc., a small but fast-growing Ontario, Calif., producer of disk controllers and board computers. "An OEM like us has to have stability; prices and supply can't fluctuate," notes Sharfi who, like Sandel, is an alumnus of Rockwell.

Sharfi had to buy CMOS memory and simple inverter parts from CAL-ABCO during the shortage, "or else not get my products out the door." But the high-priced experience rangles, and he is sticking with his neighborhood distributor henceforth. "It's a business decision, nothing personal, but others probably feel the same," he says.

Cognizant. Sandel is aware of similar attitudes, but claims that previous customers, which include firms in the Fortune 500 class, have continued to do business with CAL-ABCO. He declines to name the companies, citing the familiar reluctance of customers to own up to buying Japanese components.

Suprisingly, however, top U.S. distribution officials see little threat that CAL-ABCO will have any lasting impact in the marketplace. "It sounds different, all right," notes Anthony R. Hamilton, chairman of industry leader Avnet, Inc., and who knows few details about the firm. "They can be very successful in good times, but can they make it in the bad times because of the risk and speculative nature?"

Sandel disavows any intention of tempering his firm's plans by seeking exclusive franchises for components, in the manner of U.S. distributors. "My franchise is with the buyer," he says, "getting him the best deal possible."

—Larry Waller

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Meetings

Sixth Electrical Overstress/Electrostatic Discharge Symposium, IIT Research Institute and EOS/ESD Association (Stephen Halperin and Associates, P.O. Box 1225, Elmhurst, Ill. 60126), Marriott Hotel, Philadelphia, Oct. 2-4.

16th International Information Management Congress—Informatics 84, IMC and Micrographics Society of Singapore (IMC Informatics 84, P.O. Box 34404, Bethesda, Md. 20817), Hyatt Regency Hotel, Singapore, Oct. 2-4.

Third QualTest Conference and Exposition, Society of Manufacturing Engineers (SME, Public Relations Department, 1 SME Dr., P.O. Box 930, Dearborn, Mich. 48121), Cincinnati Convention/Exposition Center, Cincinnati, Oct. 2-4.

Northcon/84 and Mini/Micro Northwest-84, IEEE (Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, Calif. 90045), Seattle Center Coliseum, Seattle, Oct. 2-4.

27th Biennial International Electrical, Electronics Conference and Exposition, Canadian Region, IEEE (The Hilda Wilson Group, 20 Eglington Ave. E., Suite 203, Toronto, Ontario M4P 1A9 Canada), Metro Toronto Convention Centre, Oct. 7-9.

National Conference on the Advancement of Research, National Research Council (Chester McKee, Office of Scientific & Engineering Personnel, National Research Council, 2101 Constitution Ave. N.W., Washington, D.C. 20418), Colonial Williamsburg, Va., Oct. 7-10.

International Conference on Computer Design, IEEE (Albert E. Ruehli, IBM Corp., Thomas J. Watson Jr. Research Center, P.O. Box 218, D/523, 81-ZO3, Yorktown Heights, N.Y. 10598), Rye Town Hilton, Port Chester, N.Y., Oct. 7-11.

60th Fall Conference, EIA (Mark V. Rosenker, Staff Vice President, Public Affairs, EIA, 2001 Eye St. N.W.,

Washington, D.C. 20006), Los Angeles, Oct. 8-11.

Advances in Microprocessor Peripherals, IEEE (Scientific Committee, Secretariat des Journées d'Électronique et de Microtechnique, Département d'Electricité-EPFL, 16, Chemin de Bellerive, CH-1007 Lausanne, Switzerland), Switzerland, Oct. 9-11.

16th National Sampe Technical Conference, Society for the Advancement of Material and Process Engineering (Marge Smith, National Sampe Business Office, P.O. Box 613, Azusa, Calif. 91702), Four Seasons Motor Inn, Albuquerque, N.M., Oct. 9-11.

Electronics Manufacturing Technologies and Systems Conference, Society of Manufacturing Engineers (Society of Manufacturing Engineers, Public Relations Department, 1 SME Dr., P.O. Box 930, Dearborn, Mich. 48121), North Carolina State University, Raleigh, N.C., Oct. 9-11.

Third Southwest Computer Conference, Southwest Computer Conference (E. Z. Millsion, SWCC, P.O. Box 950, Norman, Okla. 73070), Tulsa Convention Center, Tulsa, Okla., Oct. 9-11.

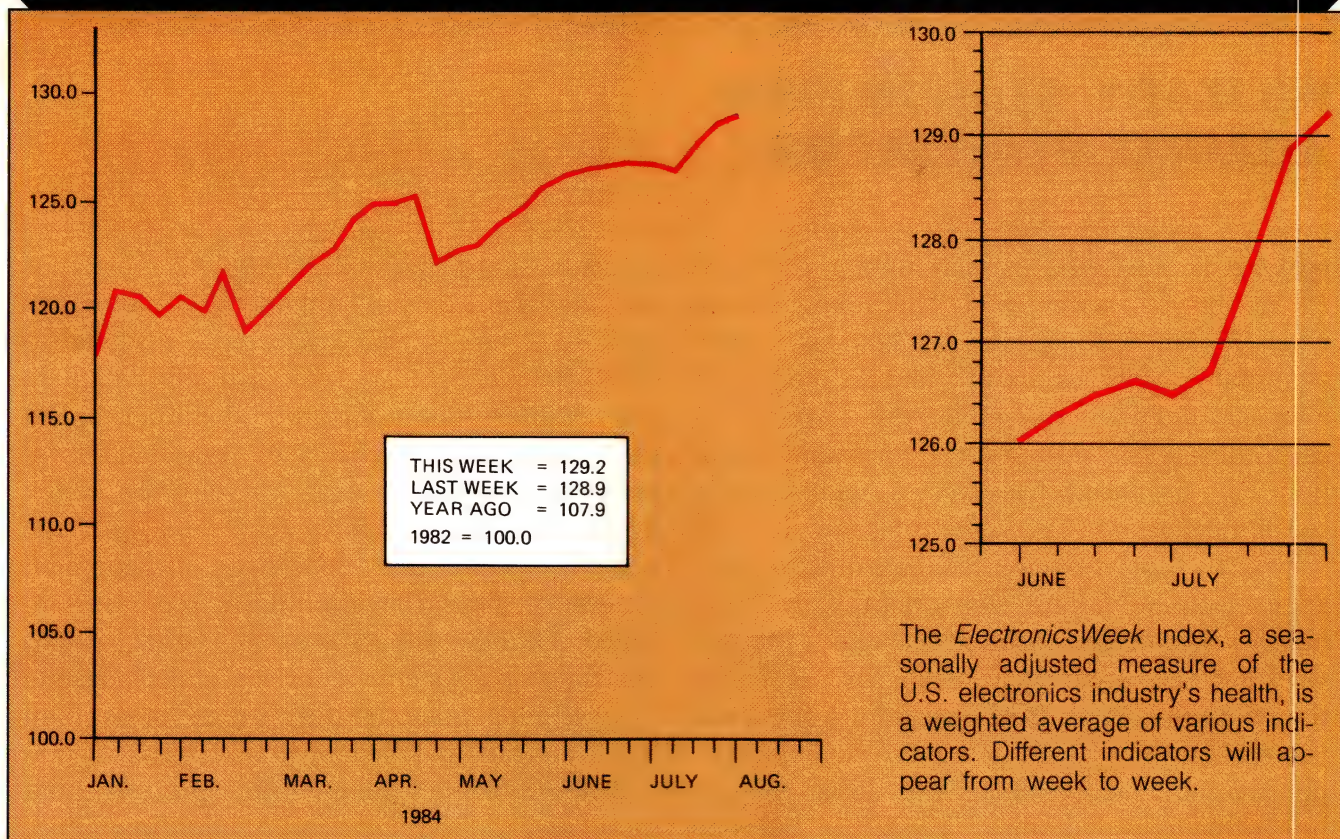
International Conference on Systems, Man, and Cybernetics, IEEE (M.E. El-Hawary, Technical University of Nova Scotia, P.O. Box 1000, Halifax, Nova Scotia B3J 2X4 Canada), Chateau Halifax Hotel, Halifax, Oct. 9-12.

Localnet 84, Online Conferences Ltd. (Online Conferences Ltd., Pinner Green House, Ash Hill Dr., Pinner HA5 2AE, Middlesex, UK), Sheraton Harbor Island Hotel, San Diego, Oct. 10-12.

Seminar

The Military Electronics Market, EIA (EIA, Government Division/Requirements Committee, 2001 Eye St. N.W., Washington, D.C. 20006), Century Plaza Hotel, Los Angeles, Oct. 9-11.

ElectronicsWeek Index



U. S. INDUSTRIAL PRODUCTION INDEX

	May 1984	April 1984	May 1983
Office and data processing equipment	315.5	301.8	263.0
Communications equipment	203.7	203.7	176.1
Radio and TV equipment	103.9	114.8	80.0
Electronic and electrical instruments	172.1 (June 84)	171.6 (May 84)	156.1 (June 83)
Components	448.0	447.7	343.2

A slight increase in the production of most electronics goods enabled the *ElectronicsWeek* Index to post a modest rise in the latest week. Manufacturers of computers and other office equipment reported the largest increase in production, up 1.5%, though the production of radio and television equipment dropped by 9.5%. The Index was also boosted by a large increase in the production of automobiles during the early part of July.

With the report that the nation's gross national product increased at an annual rate of 10.1% in this year's first quarter and 7.5% in the second, the U.S. economy is in its strongest upturn in 30 years. But not everyone finds this pleasing. Those who fear the economy could overheat welcomed the news that the index of leading economic indicators fell 0.9% in June, the first dip for this important business barometer since a 0.1% drop in August 1982. (There have been instances in recent months where the Commerce De-

partment initially reported that the index of leading economic indicators declined. But these declines were then revised upward to show actual increases in the index. Some economists feel June's reported decline could also be subsequently revised upward, although such a revision might not result in an increase for the index.)

Inflation's recent behavior, however, indicates that the economy still has some room to grow. During the second quarter, the consumer price index rose at an annual rate of only 3.3%.

The low rate of inflation continued to put downward pressure on interest rates. While the prime rate has held steady in recent weeks at 13%, interest rates on government and corporate bonds have declined, curbing fears that rates would continue to rise through the rest of the year. In addition, the Federal Reserve Board recently decided that it would not move to tighten credit unless it sees a resurgence of inflation.

MILITARY STANDS FIRM AGAINST STANDARDS

There is no herd instinct among the U.S. military services and their contractors when it comes to developing standard interchangeable parts for aircraft and weaponry. In avionics alone, for example, the response to calls during the past decade for standardization has produced five studies with specific recommendations, but very little else.

A sixth shot at avionics standardization also appears to be falling short because it lacks high-level management support within the services and the Department of Defense. Running the effort is a small triservice group, the Joint Services Review Committee for Avionics Components and Subsystems. The JSRC, which was formed in December 1980, has but one part-time representative each from the Army, Navy, and Air Force.

The JSRC has identified its first five avionics programs, on which some \$770 million could be saved if standardization were in effect. Admittedly, the dollar total is small next to industry estimates of \$50 billion in outlays for military avionics over the next five years. But it must be emphasized that the initial JSRC savings estimate limited itself to only five core avionics systems with development cost ceilings of \$25 million each, rather than the potentially more controversial and costly mission-avionics packages. Core avionics are those that fulfill some common flight requirement such as communications or enroute navigation; mission avionics are designed to satisfy a specific weapon-system mission.

Among these five candidates, all of which are well known in the military-avionics community, is the Standard Central Air Data Computer (SCADC), which could be used in as many as 16 models of Air Force and Navy planes in more than 3,600 possible installations. But the proposed \$240 million that

might be saved by using SCADC to replace 28 nonstandard items is unlikely to materialize because of money: the low priority assigned to the JSRC's efforts has created funding difficulties. Military managers would rather spend their time shepherding such big-dollar programs as the B-1B bomber or the F-16 attack fighter through Congress than fuss with the relatively small and unexciting development programs. Thus the aircraft intercom system called DADS—the Standard Digital Audio Distribution System—goes unfunded despite the system's potential for use in more than 9,400 aircraft and helicopters.

Defense officials acknowledge privately that there are, as the General Accounting Office claims, many missed opportunities for economies through avionics standardization. And DOD leaders agree with the GAO's congressional investigators that standardization deserves better support.

Why, then, the inaction? The reasons are the same as they were in 1974, when the Defense Advanced Research Projects Agency recommended 22 candidates for avionics standardization. First among them is opposition from the aircraft and avionics industries. "Contractors say they want to retain innovative ideas and diversity of products within the avionics industry," says one Pentagon engineering chief. "They argue that standardization comes from compromise, and that any economies would be more than offset by downgraded equipment performance."

Equally threatening to some is the eventual concentration of military avionics business among two or three companies. Of course, that would not happen if the services followed their own rules and developed multiple vendors. But if they haven't done it yet, what are its prospects now?

—Ray Connolly

ROAD THROUGH SILICON VALLEY TAKES KVAMME TO FINANCE FIRM

Palo Alto, Calif.

After a 15-month detour through Apple Computer Inc., E. Floyd Kvamme now finds himself where he wanted to be all along—in a high-tech venture capital firm. As an active partner at Kleiner, Perkins, Caulfield & Byers, Kvamme has joined one of the more influential companies in Silicon Valley, with more than 80 client firms.

A board member of some of those firms (including Lotus Development Corp. of Cambridge, Mass., producer of the bestselling 1-2-3 microcomputer package), Kvamme spends part of his time counseling executives on marketing strategy. It seems a far cry from his old function at National Semiconductor Corp. where he spent 16 years, most recently as head of National's plug-compatible mainframe operation, and before that as general manager of the Semiconductor Division.

At 46, Kvamme is a veteran of the explosive growth years of the semiconductor industry in Silicon Valley. A practicing engineer who wrote the General Electric Transistor Manual, he was product marketing manager for integrated circuits at Fairchild Camera & Instrument Corp. in the 1960s, when Fairchild was the leading IC maker under Robert N. Noyce. When Charles Sporck began the exodus from Fairchild by taking over as president of the then struggling National, Kvamme was one of five Fairchild executives to join him.

He took over National's computer group in 1979. Within six months, the collapse of Intel Corp. had led to the establishment of National Advanced Systems and Kvamme's metamorphosis into a mainframe-computer executive. National had been building equipment for Intel. When Kvamme left the company a year later, he was ready to pursue his dream of venture capital. Then a meeting with A. S. "Mike" Mark-

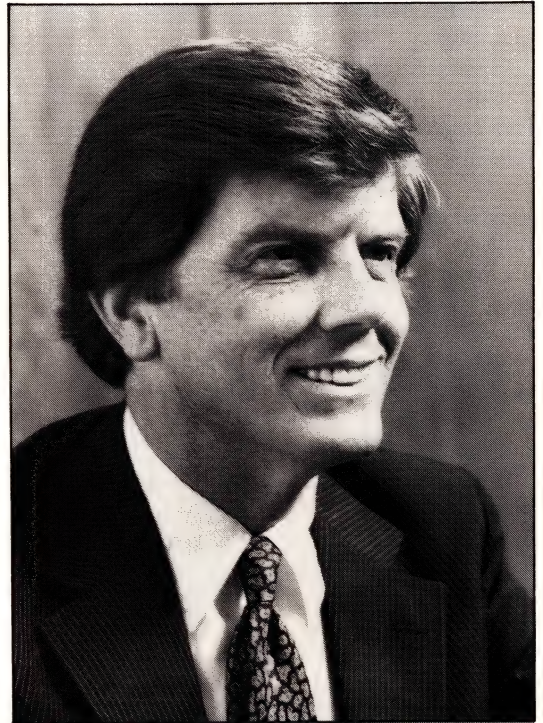
kula of Apple changed his mind.

Markkula, an old friend from the Fairchild days, showed Kvamme the then-secret Macintosh and lured him with the prospect of overseeing Apple's change from a one-product home-computer company to a more broadly based manufacturer. As executive vice-president of marketing and sales, Kvamme directed every nonmanufacturing employee outside the firm's Cupertino, Calif., home. He resigned last winter and resurfaced a few weeks later as a general partner in Kleiner, Perkins.

Now, Kvamme says, "I don't think of this job as being dramatically different from what it was in the mid-70s. Our strategy is to be very much involved with the companies we invest in. Every company will have problems, and we don't abandon our money." The stopover at Apple timed Kvamme's entry into the ven-

ture capital field just at a moment when the payoffs from taking a new firm public are becoming somewhat slimmer than they have been in the past.

—Clifford Barney



Money man. Floyd Kvamme has capped an active career in the electronics industry with becoming an active partner in a high-tech venture capital firm.

Amcodyne's Earhart foresees big future in removable hard disks

Longmont, Colo.

Just as with all new technologies and concepts in storage subsystems, the removable hard-disk drive requires time to prove itself as a reliable computer medium. Now that many major computer houses have tried the idea, removable hard disks are on the verge of winning big contracts, believes Howard Earhart, president of Amcodyne Inc.

This summer, the three-year-old

firm inked a pact to supply 8-in., 25-megabyte, fixed/removable hard-disk systems to NCR Corp. Three months earlier, Amcodyne won another multimillion-dollar contract, this time from the UK's ICL plc.

Unlike 5¼-in. units, Amcodyne's 8-in. Arapahoe 7110 is aimed at serving medium-size multiuser stand-alone computers, Earhart says. Larger 14-in. removable hard disks are more suited for main-

frames, he states. Much of the focus on reliability "comes from the very nature of the beast," and removable media often faces more stress, than do disks that are working in totally fixed environments.

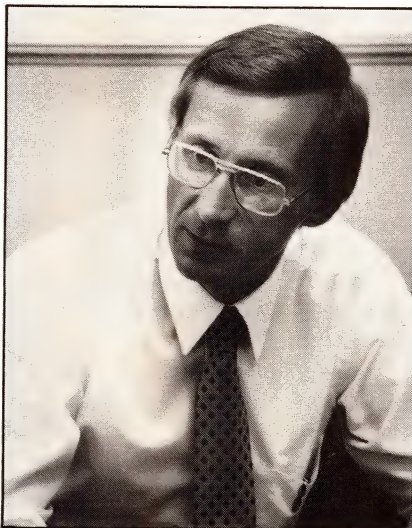
"It is also a new market, and we think there are certain applications where rigid-removable hard disk is just dead on target," he says. One promising market for 8-in. disks is engineering work stations.

Earhart, 44, joined Amcodyne as president in May 1983. Today, the firm employs 150 people and is now doubling its facility to nearly 60,000 ft². He says he expects 1985 revenues to reach between \$20 and \$40 million.

Earhart began his career in the magnetic-recording field at Eastman Kodak Co. in the early 1960s. He joined Kodak after graduating with a bachelor's degree in chemical engineering from Clarkson College of Technology, Potsdam, N.Y.

When Kodak pulled out of the magnetic-tape business in 1968, he moved to Memorex (eventually purchased by Tandy Corp.), of Santa Clara, Calif., rising to president of

the Consumer Products Group. In 1981, he became president of recording-head maker Information Magnetics Corp. in Santa Barbara, Calif. In that position, "I had an opportunity to [deal with] all the disk-drive companies, and I concluded that Amcodyne had the best technical team," he says. —**J. Robert Lineback**



Aiming high. Howard Earhart thinks there are applications where the rigid-removable hard disk is right on target.

After graduating from the University of California, Los Angeles, in 1971, Finn began his career not in computers, but in chemistry. "I was using computers in my work, and the computers were more interesting than the chemistry," says Finn, a California native.

He moved on to the University of Southern California, where he worked in medically related computing, and then over to the University of California, San Francisco, directing projects in computer-controlled analytical instrumentation. Data General persuaded him to trade jeans for a three-piece suit and work on financial systems as a systems engineer.

That's where Finn was working when he was offered the opportunity to work on the Eagle project at Data General's home base in Westborough, Mass. A year after the Eagle was completed, Finn left Data General for SOLVation, a start-up microcomputer company. The experience at SOLVation, he says, taught him how to deal with venture capital people and the details of a start-up. EnMasse was founded 10 months ago by Finn and others who believed they spotted a niche for systems priced below the fault-tolerant systems now offered by Tandem and Stratus. Their system, Finn says, will be sought by companies that are in the \$10 million to \$15 million range. "A transaction system for the masses," Finn calls it.

In a marathon weekend session, Finn, Robert Downs (now president of EnMasse), and two others hammered out the system's architecture. When they got into hiring, a high priority was put on recruiting senior

people, those with 10 to 15 years' experience. That kind of experience, Finn says, means people will know how long a project will take to complete. All told, he says, the EnMasse team will be compressing into 10 months the research and development that might take three or four years somewhere else. —**Craig Rose**

Finn aims to shoot down prices of fault-tolerant computers

Acton, Mass.

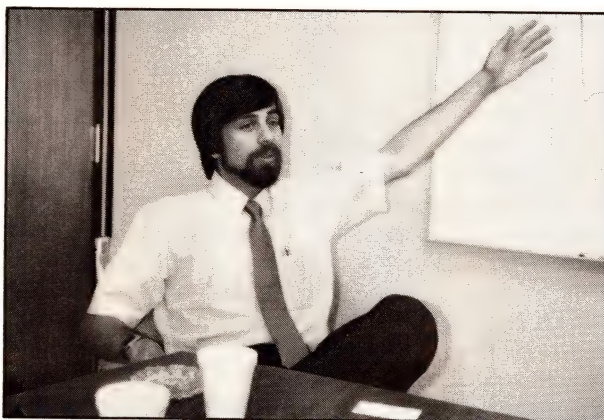
Claude Finn says he owns no shoes—just 20 pairs of cowboy boots—and he rides horses whenever he can. So it's no surprise when he describes his latest project as an attempt to build a computer system that will perform like "the hero who might get shot in the right arm, but can shift his gun to the left to blow the bad guy away."

What Finn is planning is an fault-tolerant, expandable, multiuser system that is based on microcomputers. What will make it unique, he says, is that it will be priced substantially below existing systems.

The 34-year-old Finn is vice president of software for EnMasse Computer Corp. here. He is also a veteran of the Eagle project at Data General, made famous in *The Soul of a New Machine*.

Existing fault-tolerant systems are fine for "iron lungs and elevators,"

says Finn, where maximum continuity of performance is essential. The system EnMasse is building can fail on rare occasions, he says, "but data integrity will not be compromised. Failing once in a while is not a problem [for many applications] if the data comes back intact."



Mass appeal. Claude Finn is helping design a fault-tolerant computer system for companies in the \$10-\$15 million range.

Computer Systems

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Industry news and trends.

Systems: IBM links micros to mainframes
Military turns to rugged VAXs

Microcomputers: Portables set to lab the market

Software: Symphony debuts as siblings of 1-2-3

DOD mandates use of ADA

Peripherals: Voice recognition boards make their way in marketplace
Touch screen system cuts transaction time

Components: Gallium arsenide ICs aimed at Japan's 1990 computers
Honeywell to use NCR/32 chip set

Technical articles.

System packaging and board design in the IBM 4381, by Robert Smith and Jack Jones, IBM Data Systems.

Designing gate array logic with a personal computer, by Harvey Firestone and Paul Muni, Futurenet Corporation.

Error correction and detection in magnetic media, by George Herman, 3M Corporation.

A superminicomputer with powerful graphics, by Isaac Schwartz, Pyramid Computer Corporation.
Designers Notebook: Microcontroller drives two disk drives; Evaluating stepper motors.

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1984 Issue dates.

September 1, 1984
November 1, 1984

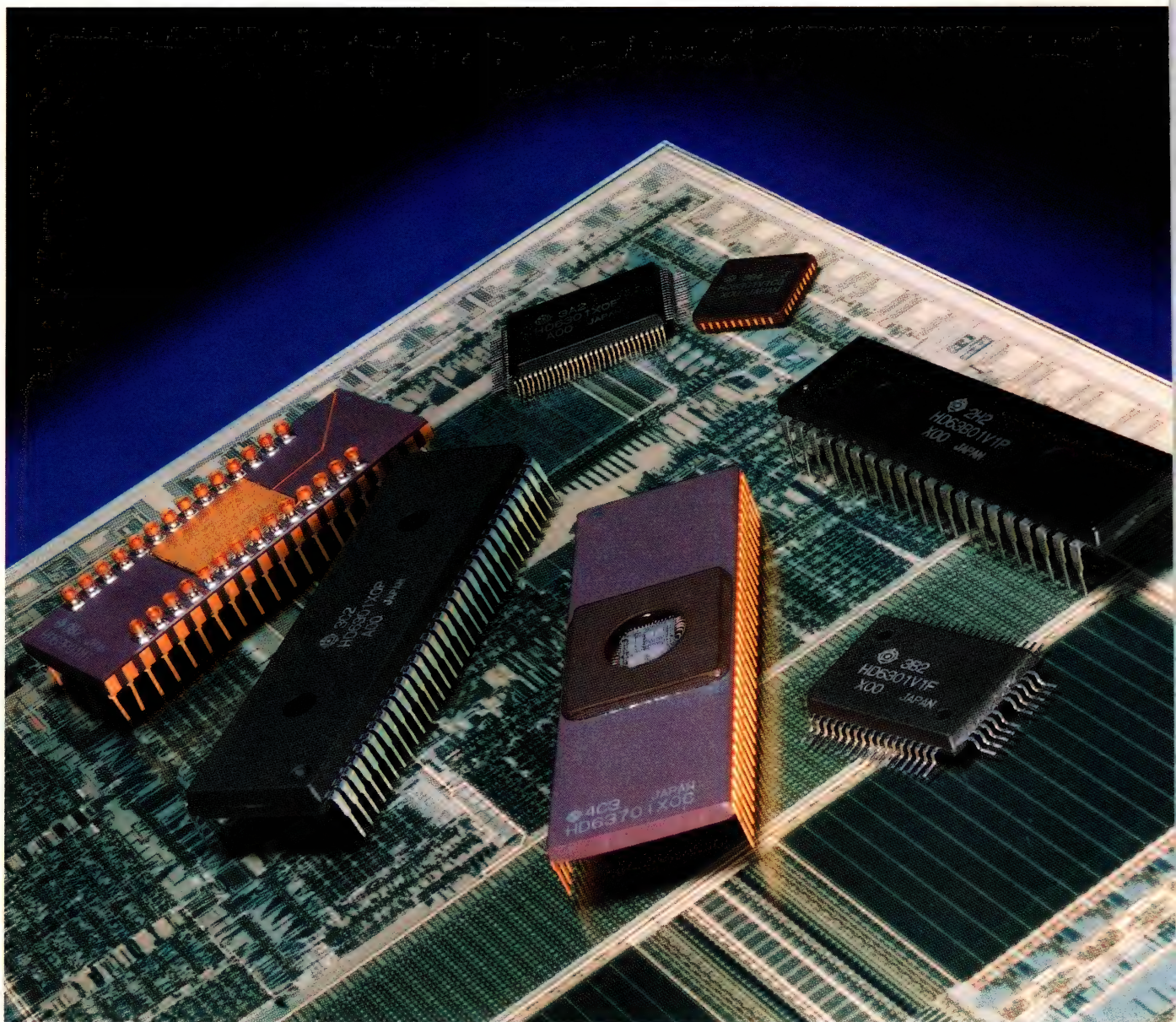
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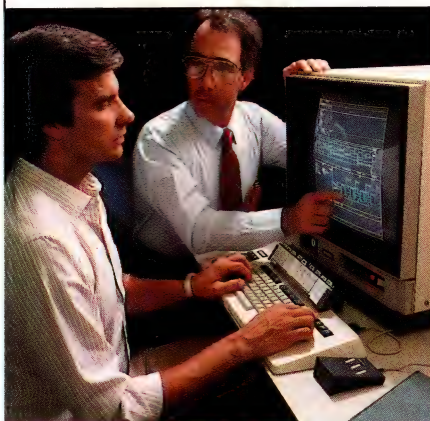
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SINGER, SYNONYMOUS WITH SEWING, SUCCEEDS WITH STRATEGY SWITCH

Stamford, Conn.

There comes a time for many companies when their management must decide either to redesign their business operations radically, seeking new opportunities and dropping older, established businesses that offer little growth, or to wither and die. The Singer Co., one of the first multinational firms in the history of the U.S., faced just that kind of decision.

Singer from the mid-1800s until the early 1960s was geared almost exclusively to producing and selling sewing machine products. With most of its employees and facilities entrenched in that business for over a century, Singer faced a difficult and painful task when it decided in 1979 to make massive cutbacks in its traditional business in order to shift its focal point to a newer technology and higher growth area in which the firm was already involved: aerospace electronics. Singer has attained its goal. "The fact is that aerospace electronics now represents half of the company," says president William Schmied.

The transformation has proven highly profitable. Singer's net income in the just-ended second quarter was higher than in any comparable period during the past seven years, and earnings for the first half of 1984—\$33.4 million—exceeded earnings for all of 1983 (see figures). Wall Street analysts, noting that the firm's North American Consumer Products Group has been a major source of cash for fueling new ventures in aerospace and military electronics, expect income for 1984 to reach over \$65 million. Bear Stearns & Co. is now recommending Singer stock for "aggressive purchase," according to Morton Langer, the firm's senior aerospace analyst.

While shutting down many of its sewing machine plants and selling off retail outlet stores, Singer has busied itself making productivity im-

provements, constructing new facilities, and becoming involved in new businesses. For example, its Controls Division, which makes electronic devices for consumer appliances, has installed automated test equipment and advanced robotics. New facilities for its Librascope Division, in Glendale, Calif., and a building in Lanham, Md. for HRB-



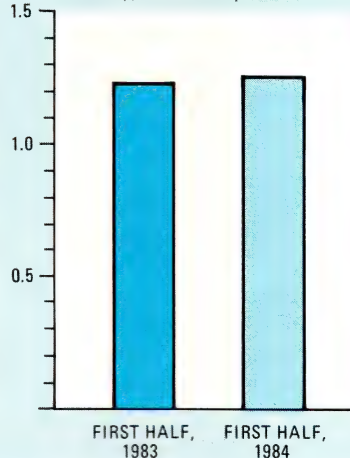
Decisions. "Anything is possible," says Singer Co. president William L. Schmied about new business directions to be pursued.

Singer Inc. were recently completed. Singer has launched Simuflight International, a promising subsidiary that uses the company's flight simulators to educate military, commercial, and corporate pilots. And less than two months ago its Link Simulation Systems Division acquired Omnidata, a Cherry Hill, N.J. developer of equipment and associated software for training personnel and process-control operations.

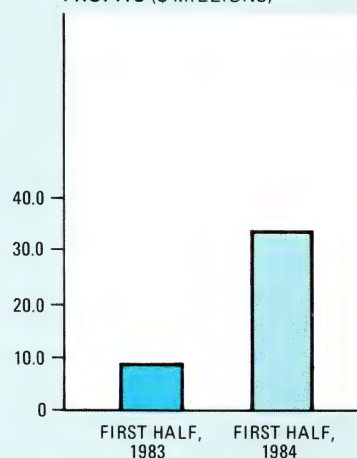
Singer spends about \$30 million annually on internal research and development, says Schmied, who was appointed to his post in 1980. (Schmied joined Singer in 1969 as chief executive and general manager of the Kearfott Division, and in 1971 was appointed group vice president of the company's aerospace and marine systems operations.) Singer is investing heavily in such areas as the building and testing of laser gyroscopes, he notes, and the firm is developing 20 new products in the controls division.

Still, the firm has not ignored its first business. Singer later this year will introduce a new line of sewing machines, hoping to compete effectively with imports. "Singer has

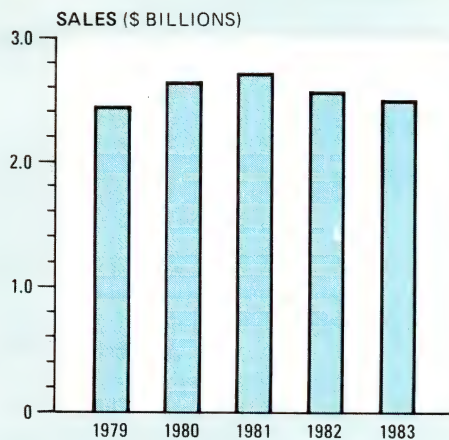
SALES (\$ BILLIONS)



PROFITS (\$ MILLIONS)



Profitable. Buoyed by its aerospace electronics and North American consumer operations, Singer has already earned more in the first half of 1984 than in all of 1983.



Stable. Singer's net sales have remained relatively flat over the past five years as it has sought to transform its mix of business revenues, while its earnings have fluctuated, with losses in two of the past five years.

made a lot of progress in this area," says Jonathan Progoff, an analyst with E.F. Hutton & Co.

To further expand its Government Products Group, which surpassed \$1 billion in revenues in 1983, Singer hopes to make further high-technology acquisitions. "Our balance sheet is in the kind of shape where we can make a modest acquisition in aerospace electronics," says Schmied. In addition to heightened earnings, a financial restructuring has allowed Singer to start shopping. Last year it replaced financing whose interest was linked to the prime rate with \$132.5 million in fixed-rate long-term loans. Of the new funding, \$100 million is at a rate of 9%, while the remaining \$32.5 million is at 11.5% rate. "We had debts of over \$1 billion in 1975, which are less than one-half billion

now," says Schmied. The sale of equity in some of its Far East subsidiaries will also reduce debt by as much as \$100 million this year, he says.

Government Products, which encompasses such divisions as Link Flight Simulation, Binghamton, N.Y.; Link Simulation, Silver Spring, Md.; and Kearfott, Little Falls, N.J., is now contributing about 50% of total corporate revenues, up from just 27% in 1980. This group has developed the guidance system for the Trident missile, the aircraft navigation system for the F-16 fighter, and the Joint Tactical Information Distribution System. JTIDS, which could eventually yield over \$1 billion in sales, Schmied says, provides encrypted, jam-proof digital data transmission. The Kearfott Division, which can design and lay out integrated circuits, is advising Intel Corp. as it develops its model 432 32-bit microprocessor. Although Singer designs ruggedized computers for its various systems that will operate in hos-

tile environments, it has no plan to make computers for consumer applications, Schmied says.

Link Simulation Systems, which produces simulators for power-plant, industrial-control, and military-tactics applications, has installed about 60 nuclear-power-plant simulators at prices ranging from \$3 million to \$8 million each. The division, now creating systems for pharmaceutical companies and plastics plants, will consider designing a simulator for "anything that requires control of a complex industrial process," Schmied notes.

The company's heavy dependence on government contracts has actually increased its financial stability, Schmied contends, rather than leaving Singer at the mercy of government spending policies. Singer develops and upgrades command, con-

trol, and communications systems, rather than making hulls and airframes. Even if military spending is cut by 25%, "they'd still have to make improvements [to existing systems]," says Schmied. "Over the years when there have been cuts, that's how it's happened time and time again," he adds. Notes Bear Stearns' Langer: "Singer is involved in military programs that are vital and unlikely to be cut."

Despite its strong commitment to aerospace electronics, Singer remains dependent on the fruits of its North American Consumer Products Group. "They're using consumer products to generate cash to fund aerospace and marine systems," says Progoff. Composed of the North American sewing operations, motor products, controls, and furniture, the group makes consumer power tools sold by Sears, Roebuck & Co., electronic devices for cars, and appliances, and fluid-measurement-control devices for the gas industry. Sewing machines and related products are responsible for about 22% of its revenues. After suffering losses in 1980 of \$46.2 million on sewing products in the U.S. and Europe, Singer shut down excess manufacturing facilities, and sold 700 of 1,450 European stores and all but one in the U.S.

Singer has no immediate plans for more drastic alterations of its business mix. "Businesses outside of sewing and aerospace electronics have to be analyzed in a critical way to see which ones over the long term will be contributors with this new direction," says Schmied. "But you have to remember that anything is possible."

—Steve Haggerty

BOTTOM LINES

Intel in the East. To meet the new business needs of its Far Eastern computer systems business, Intel Corp. has leased a plant in Singapore to assemble single-board computers. Up to 500 people will be employed at the plant when it becomes operational in September, according to the Santa Clara, Calif., firm. The company also has an option to acquire 15 acres of land in Singapore to build a permanent plant to assemble board-level and fully integrated systems.

1984 EUROPEAN INTEGRATED CIRCUIT PROCUREMENT SEMINAR



1984 EUROPEAN INTEGRATED CIRCUIT PROCUREMENT SEMINAR

* Please note: *In Copenhagen only*, the schedule will run 30 minutes earlier than shown below.

9:00 a.m.*	Registration	12:00 noon	Memory Review (SRAM, DRAM, EPROM, EEPROM)
9:30 a.m.	Introduction Malcolm G. Penn Vice President, Director European Semiconductor Industry Service		Stan Bruederle • Business Update • Density Update • Density Trends • Bipolar versus MOS
9:45 a.m.	Industry Update Worldwide Business Climate Stan Bruederle Vice President, Director Semiconductor User Information Service • Economic Analysis • Electronics Markets • Integrated Circuit Trends European Review Adrian R. Tarr Senior Industry Analyst European Semiconductor Industry Service • Regional Market Updates • Integrated Circuit Industry in Europe — Products — Suppliers — Market Share Analysis	12:45 p.m.	Lunch (Provided with Seminar)
		2:00 p.m.	Microprocessors Malcolm G. Penn • Business Update • 8-Bit to 16-Bit Conversion • 16-Bit to 32-Bit Conversion • Trends to CMOS • EEPROM Memory
		2:45 p.m.	Logic Stan Bruederle • Business Update • CMOS versus Bipolar • Replacement by ASICs • 74ALS, 74F, 74AS, 74HC/HCT
11:00 a.m.	Break	3:30 p.m.	Break
11:30 a.m.	Technology Overview Adrian R. Tarr • Trend to VLSI • Trend to CMOS • Packaging Trends — VLSI Packaging — Surface-Mounted Packaging	4:00 p.m.	ASICs, (PLAs, Gate Arrays, Standard Cells, Custom) Malcolm G. Penn • Market Trends • Selecting the Right Product • Choosing a Source • The Supplier-Customer Interface

NOTE: During each product business update we will present our market forecast, price trends, lead times, capacity versus demand, product life cycle analysis, and supplier review.

4:45 p.m. Wrap-Up
5:00 p.m. Meeting Adjourns

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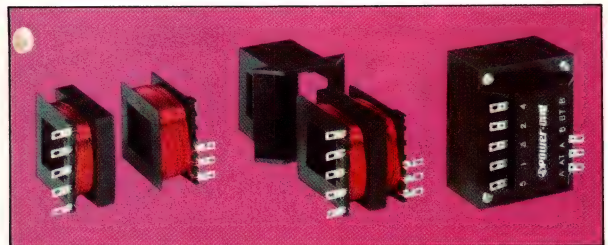
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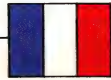
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	5V @ 18A	\$119.95					CP131-A	5V @ 8A	12V @ 1.7A OR 15V @ 1.5A	-12V @ 1.7A OR -15V @ 1.5A OR -5V @ 0.7A	\$119.95
12 VOLTS HB12-1.7-A HC12-3.4-A HN12-5.1-A HD12-6.8-A HE12-10.2-A	12V @ 1.7A	\$ 32.95					HDBB-105W-A	5V @ 12A	12V @ 1.7A OR 15V @ 1.5A	-12V @ 1.7A OR -15V @ 1.5A OR -5V @ 0.7A	\$134.95
	12V @ 3.4A	\$ 49.95									
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15 VOLTS HB15-1.5-A HC15-3-A HN15-4.5-A HD15-6-A HE15-9-A	15V @ 1.5A	\$ 32.95	SINGLE OUTPUT MODELS			DISK DRIVE MODELS					
	15V @ 3A	\$ 49.95									
	15V @ 4.5A	\$ 69.95	MODEL	VOLTAGE / CURRENT	PRICE (1-24)	MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	PRICE (1-24)	
	15V @ 6A	\$ 79.95	28 VOLTS HB28-1-A	28V @ 1A	\$ 32.95	CP205-A	5V @ 1A	-5V @ 0.5A	24V @ 1.5A/1.7A PK	\$ 75.95	
	15V @ 9A	\$109.95	HC28-2-A	28V @ 2A	\$ 49.95	CP206-A	5V @ 2.5A	-5V @ 0.5A	24V @ 3A/3.4A PK	\$ 99.95	
24 VOLTS HB24-1.2-A HC24-2.4-A HN24-3.6-A HD24-4.8-A HE24-7.2-A	24V @ 1.2A	\$ 32.95	HN28-3-A	28V @ 3A	\$ 69.95	CP162-A	5V @ 3A	-5V @ 0.6A	24V @ 5A/6A PK	\$129.95	
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	24V @ 3.6A	\$ 69.95	HE28-6-A	28V @ 6A	\$109.95	CP379-A	5V @ 6A	-5V @ 1.2A OR -12V @ 1.2A	24V @ 3.5A/8A PK	\$129.95	
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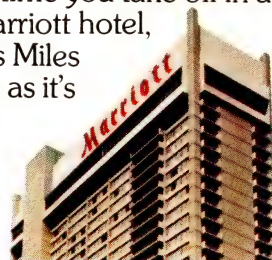
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DIGITAL CIRCUITS POINT TOWARDS BETTER TV SETS

As the technology ramps up, TV manufacturers start to introduce products that live up to digital's potential □ *by David M. Weber*

Video products have seen more changes in the past decade than any other category of consumer electronics, and they continue to change and develop. Right now, the most important changes in their technical capabilities are in the areas of digital signal processing and digital high-definition television (HDTV).

Because the theoretical advantages of using digital circuits are so apparent (freeze frame, zoom focusing, picture within a picture, and higher overall picture quality), every major manufacturer of video equipment has plans to introduce products based on digital technology. A manufacturer doesn't have to wait until the broadcast standards change or until his government rules that the technology is acceptable, since virtually every new capability that digital TV offers can be implemented in the receiver.

Digital TV has not yet reached the market in any significant degree. The major manufacturers of TV receivers have been proclaiming the imminence of their companies' digital-TV introductions during much of 1984, but their actual steps into digital waters have been slow and tentative—mostly because the chip standards have not yet been resolved.

The digital processing of a video signal depends on the very large-



1. High-definition. Digital TV will have over 1,000 lines of horizontal resolution—giving a sharper picture with greater color fidelity. The top picture shows the standard NTSC image with a 525-line resolution; the bottom picture has a resolution of 1,050 lines.



scale integrated circuits that began appearing commercially for video applications at the start of the 1980s, when ITT Intermetall GmbH, Freiburg, West Germany, did its pioneering work on digital ICs for processing TV signals [*Electronics*, Aug. 11, 1981, p. 97]. With faster processing of more complex signals across a bandwidth of several megahertz, video images could be stored, altered, or linked to other video devices using lightweight and very compact equipment.

Japan takes the first step

Matsushita Electric Industrial Co. kicked off Japan's digital-TV age on June 11 with a 20-in. set that lists for \$1,046.43. The unit has a 5-in. insert picture and remote control that also activates a video cassette recorder and video disk player (Fig. 1). Because the remote control signal is generated by an 11-bit digital signal system, it is theoretically able to control up to 2,048 functions. The remote control unit currently in production controls 61 functions, including color saturation and brightness, as well as the various functions of a VCR, video disk player, video camera, and computer.

Matsushita claims that the set has 30% fewer parts than a high-end analog set and that the digitization of the analog broadcast signal perceptively reduces screen flicker. It is turning out only 3,000 sets a month, however, a negligible number in Japan's huge market. But this is not to say that the Osaka firm's competitors believe it's on the wrong track in developing the beginnings of a digital product line.

Following Matsushita will be Sony Corp., Tokyo, which is expected to announce its product in mid-August, with sales to start by year-end. At that time, Toshiba Corp. and Mitsubishi Electric Corp., both in To-

2. Enhanced features. Current-generation digital receivers have enhanced videotex resolution as well as the ability to display another picture from a second video source such as a video cassette recorder or disk player. Digital processing at the signal inputs permits every function to be controlled remotely.

kyo, will probably announce sets for shipment sometime in 1985. Sanyo Electric Co. and Sharp Corp., both in Osaka, are awaiting the reaction of the market before committing themselves.

One major firm is unimpressed by the present action and has decided to make a slow transition to digital TV. Hitachi Ltd., Tokyo, appears to be waiting until the price of digital random-access frame memories falls enough to make them practical in consumer sets. These sets could then offer all the benefits inherent in digitally processing TV signals.

In fact, the trend is clear; some of these benefits have been realized by the Digit 2000 chip set [*Electronics*, April 5, 1984, p. 89], developed by ITT Intermetall GmbH, the lead house of the ITT Semiconductors Group. Five LSI and VLSI circuits convert the analog audio and video TV signals to digital signals at the demodulator's final

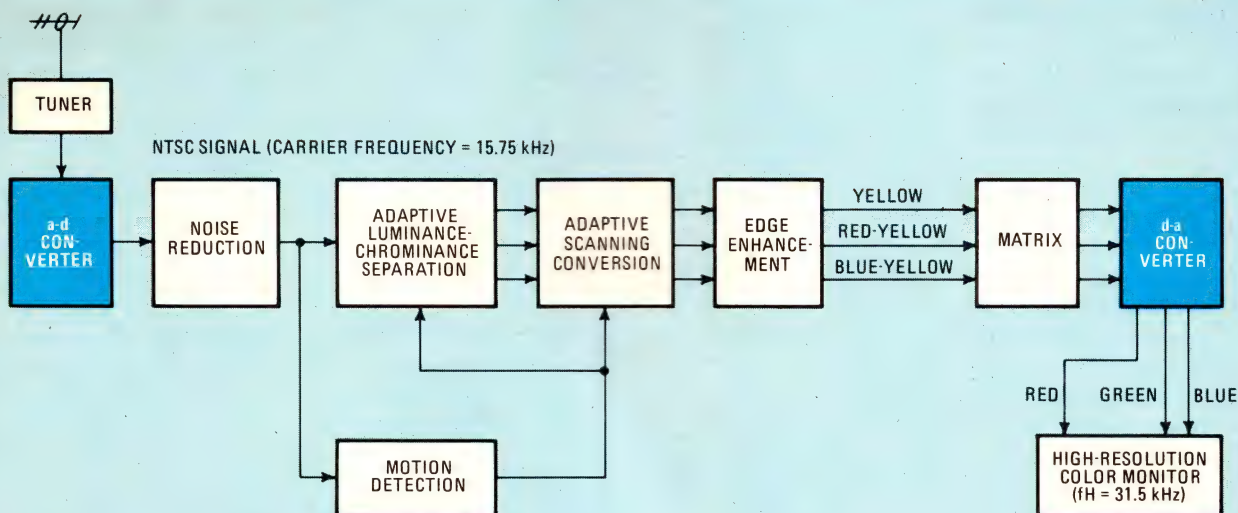
output stage. A video codec, video processor, and deflection processor handle the composite video on three separate chips; another chip handles the audio, and one more carries the microprocessor that acts as the central controller. Packing so much functionality into the chip set greatly reduces the component count in a receiver's chassis. Instead of the complex wiring needed for picture adjustment in analog sets, the Digit 2000 system simply programs the digital circuits with the required parameters and corrects flaws in the transmitted signal according to the preprogrammed instructions.

ITT sets standard

The system is the most widely used technology currently in production—for instance, among the Japanese firms involved in digital television production, only Mitsubishi isn't using an ITT chip set: it will initially use its own ICs but will most likely use ITT chips in its second-generation receivers.

But the chip set is not without its critics. Though everyone applauds its ability to provide full-feature remote control and two-channel viewing (a picture within a picture), its performance in production-model sets has been uneven. Matsushita, for example, is using an early version of ITT's chip set and has had to shield both individual chips and circuit boards extensively so that radiation originating in one circuit doesn't interfere with the others. (ITT's has solved this problem in its newer chip sets.) In addition, Matsushita considers the fabrication costs high. But the firm invested heavily to get an early license from ITT, and with its TV division's prestige on the line, it will continue digital development.

ITT, though the industry leader, has not been alone in developing circuits for new TV receivers. Philips, Eind-



3. A-d conversion. In converting analog TV signals to digital, the incoming broadcast is digitized, chroma and luma are separated, and picture edges are enhanced. Composite video would also be possible by removing the functionality for red-green-blue separation.

hoven, the Netherlands, has integrated digital and analog circuitry onto a two-chip set—a development that should further reduce both components count and manufacturing costs. Sinclair Research Ltd. and Motorola Inc. have also developed hybrid analog and digital ICs for processing video signals.

TV makers plan development

Some firms, including Sony, are awaiting the availability of an improved ITT chip set, which will feature a lower signal level producing less radiation than the older chip set used by Matsushita. The set's design and features may differ markedly from one earlier fabricated by Sony that used a large number of its own digital chips [*Electronics*, Sept. 8, 1983, p. 77]; one important difference will be the smaller number of chips in the ITT set.

Hitachi, which is holding back from consumer introductions, has nonetheless been active at the very high end of the professional market. Its subsidiary, Hitachi Denshi Ltd., now manufactures a digital signal-processing adapter for movie theaters using General Electric Co. large-screen projection systems. The inclusion of sufficient memory to store a full NTSC TV frame made it possible to incorporate both sophisticated signal processing and noninterlaced scan. The adapter lists for \$30,000, and is in a cabinet the size of a small refrigerator.

Despite the prevalence of ITT's equipment, Japanese IC manufacturers will still get into the act. All color TV manufacturers there expect TV signal processing to become digital in the future, and all are working on families of multifunction chips. But it will only become economical for them to produce their own chips when sales of digital TV sets have grown to reasonable levels and they can implement all required functions with a chip set that includes only a small number of discrete ICs.

The industry consensus is that the central issue in digital television is not features—which can be added one on top of another using current technology—but picture

quality. So far, a truly improved picture has appeared only at a cost well beyond the consumer's reach.

GE, which was expected to announce a number of digital TV receivers in spring 1984, announced instead that it would hold off production until it could offer the consumer a visibly better picture than a comparably priced analog model. Judy Ziegler, spokeswoman at the Portsmouth, Va., plant, says GE sees digital TV as "driven by what the customer actually sees in the showroom—in terms of better resolution, higher contrast, sharper color, etc. Features like a second picture from another channel within the picture you're watching may sell some high-end models, but digital TV won't really take off unless picture *quality* is shown to be better."

The thinking throughout the industry is that the best approach is not to get there first, but to get there right. Toshiba's experience at the June 1984 Consumer Electronics Show was an object lesson to many marketing people. Toshiba demonstrated a digital set with some intriguing features, but those who saw it generally agreed that the digitally processed picture was poor. And with a price tag of \$1,200 when the set is introduced in the U.S. this fall, no one was predicting brisk sales.

Still, Toshiba expects that its picture-within-a-picture feature, which superimposes an image 1/16 or 1/4 the size of the main 20-in. picture in any corner of the screen, will capture enough of the market to make the company's efforts worthwhile. The insert itself is a digitized version of the analog-based picture insert originally marketed by Sharp and by Grundig AG, of Fürth, West Germany [*Electronics*, Jan. 4, 1979, p. 48].

Rich Meidenbauer, National Advertising Director for Toshiba, expresses confidence that the demo set's apparent poor resolution was simply because "the set was just out of the R&D labs, and any problems with picture quality will be ironed out when the production models are introduced." He says the new set has 256-K of memory, enough to allow the small picture to be frozen, but

insufficient for zoom focusing or the enhancement of the picture. In addition, it has only one tuner, so either the main or the subsidiary picture must come from a video input. Thus the viewer can watch only one rf channel at a time; the other picture must come from a VCR, video disk player, or computer. The set also has multichannel TV sound (see "Stereo and bilingual TV stirs interest"), so it can be used in bilingual and stereophonic-sound transmissions. Additional features would include direct monitoring, eight-pin red-green-blue connections for video and computer inputs, and a 21-pin RGB interface for high-resolution applications, with hookups to videotex, teletext, and satellite inputs.

While Toshiba is billing its set as a forerunner of things to come, other manufacturers don't expect digital television to be fully competitive with conventional TV until 2.5 to 5.0 Mb of RAM are available for frame storage—at the right price.

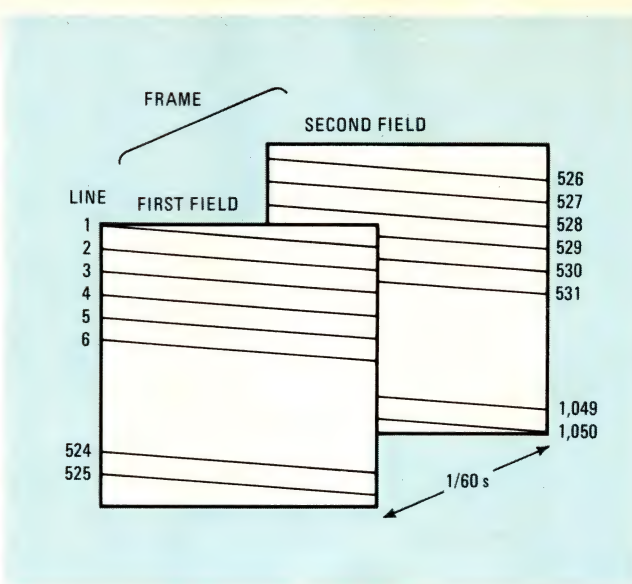
According to Frank McCann, RCA Corp.'s vice president of public affairs, the company is evaluating various technical approaches to digital TV receivers. Meanwhile, it has yet to resolve cost versus performance. The goal of the New York company is to produce digital TV receivers whose performance levels equal or better those of current analog TV receivers. Thus it might hold off introduction of its own line of digital TV receivers, though it still plans to be a significant player.

ITT plans to move forward

To hasten the day when RCA and others make a firmer commitment to digital, ITT gave the following timetable:

- The current generation with five chips containing basic features but with improved sound and video.
- For introduction in 1985, a new generation of seven chips with ghost-free teletext, compatibility with PAL and SECAM, and an integrated service computer.
- By 1987, flicker-free reception, and still lower manufacturing costs per function.

On the basis of its present production in Europe, ITT claims that it has reduced manufacturing time (including test and repair) of its prototype digital sets to 315 minutes per unit. A comparable analog set takes about 350 minutes to assemble, so in at least one respect a potential savings in production costs has already been realized. The main cost factor to overcome is the expense of the VLSI chips that must be used for frame storage; these are considered custom items by chip manufacturers such as ITT and Motorola, and until the TV



4. Fields are combined. Interleaving from the broadcast signal is eliminated from the first field. Picture information from the second field is superimposed on the first between the horizontal lines. The two fields are recombined in a single high-resolution frame.

producers decide what features they want in common, the mainstream memory market will probably not find it worthwhile to produce the 256-K chips in quantity. Without the 2.5 to 5 Mb necessary for full-frame picture storage, the greatest potential benefit of digital TV—HDTV—won't be realized.

That HDTV is desirable is not an issue, however. From the consumer's perspective, the greatest advances in television quality will come from simply boosting the picture's definition, color quality, and aspect ratio. To that end, TV manufacturers are making substantial efforts to develop HDTV at con-

sumer prices.

A paper delivered at the recent International Conference on Consumer Electronics in Chicago addressed itself to the issue of HDTV from a standard NTSC broadcast signal using digital signal processing. Since enhancement occurs at the receiver, requiring no change in the broadcast system, it is considered the most realistic approach to better-quality TV. The paper's authors, led by Norio Suzuki of NEC Corp., in Kawasaki, describe a circuit (Fig. 2) that eliminates ghosts by using frame-to-frame correlation. The noise reducer has nonlinear characteristics that can reduce small-amplitude noise without causing degradation in the picture quality. Image edges are further enhanced with transversal filters operating both horizontally and vertically.

In addition, the circuit uses a digital comb filter to separate luminance and chrominance. The filter employs frame and line memories for still and moving picture elements, respectively. The memories are adaptively controlled according to the motion of discrete pixels in relation to adjacent pixels in the same field.

To actually realize a high-definition picture, NEC uses adaptive scanning conversion. This converts the NTSC signal, which has 525, 2:1 interlaced scanning lines, to 525 noninterlaced lines and superimposes it on a previous frame (Fig. 3). The resulting 1,050 scanning lines make disturbances in the structure of a single line barely visible, because the increased number of lines in the frame will dissipate any artifacts introduced into a line. Two methods enable this conversion to take place: line and field interpolation. For line interpolation, the luminance of an interpolated pixel is calculated from the pixels on two adjacent horizontal lines in the same field. For field interpolation, an interpolated pixel is similarly obtained from the corresponding pixel in the previous field.

According to Suzuki, the processed picture has "fine resolution, no ghosts, and is free from such impairments

Stereo and bilingual TV stir interest

Television with two-channel stereophonic sound started in Japan five years ago and was introduced in Germany during the Radio and Television Exhibition in West Berlin in September 1981. Since then, the installed base of German sets with stereo reception has risen to about 4 million units. The Germans seem pleased with the quality of musical programs in stereo, but according to the Central Association for the Electrotechnical Industry, Frankfurt, they are even more enthusiastic about being able to receive two channels of speech—that is, selecting the soundtrack from a program in either the original language with subtitles or dubbed.

In the U.S., stereo broadcasting is ready to take off; in fact, the high-end sets of every major manufacturer have been stereo-ready for at least the past year, and all the new digital sets will be stereo. But the broadcast standard differs from the German and Japanese versions: though foreign systems give broadcasters the option of either stereo or dual-language monaural sound, the U.S. system permits reception of high-fidelity stereo as well as reception of a simultaneous second language in lower-fidelity monaural sound. Some mono sets on the market can be modified with adapters that will be able to pick up a stereo or bilingual broadcast. GE and Sony have announced plans to sell

adapters that will permit their sets to receive the new transmissions as soon as they are initiated.

Zenith Radio Corp. developed the *de facto* standard for the secondary audio program (SAP). According to Carl G. Eilers, an engineer at Zenith's Glenview, Ill., headquarters, the basic technical parameters for the main audio signal can be described by two subcarriers and a channel-difference audio signal. The subcarrier for the SAP is five times the horizontal line rate of 15.75 kHz, while another subcarrier, called the professional subchannel, is intended for data or low-fidelity voice transmission. Its frequency is 6½ times the horizontal line rate.

To achieve truly high-fidelity sound, some form of noise reduction was necessary. Zenith therefore entered into an agreement with dbx Inc. to use the Newton, Mass., firm's compander. More sophisticated than the familiar dbx-II used for home audio tape, this noise reduction system is based on complementary audio processing at the transmitter and at the receiver. It applies a variable pre-emphasis to the audio at the level of the SAP subcarrier, since that's where most of the noise is introduced. The transmitter has a separate SAP compressor, the receiver a single expander for both stereo and SAP.

as line flicker, large area flicker, dot crawl, and crossed color." They stress that adaptive digital signal processing must take motion into account to present a visible advantage over standard processing of a broadcast signal, because the two superimposed 525-line frames are ever-changing and must be precisely aligned.

The real beauty of digital frame storage in HDTV is that it works independently of the broadcast standard; PAL or SECAM would give results equally good, or better, with only slight modification of the signal processing at the demodulator. Motorola Inc. has developed a 5,000-device hybrid IC that can process a video signal in all three color standards [*Electronics*, Feb. 10, 1983, p. 85] using a digital circuit for the time base and a capacitor for the signal sampling.

Thus the technology is around—as are high production costs. But TV makers can offset some of those costs by charging a hefty price for the receivers—which they hope to justify by offering superior resolution for both broadcast pictures and for videotex systems.

Current systems use only part of the bandwidth allotted for each channel. But a technical expert at the Electronic Industries Association, Washington, D.C., who asked not to be identified, predicts that much of the move to HDTV will be fueled by videotex originators, who will thus be able to offer full-field information on a full-bandwidth cable channel. He does not predict a move to HDTV broadcasting: "The production difficulties inherent in the conversion of a widely used broadcast standard are simply too great." He thinks the way to go is to enhance the existing standards with the signal processing techniques already mentioned.

Alternatively, compression techniques, which are being developed at the EIA's Advanced Technical Standards Committee, might be able to squeeze high-defini-

tion video information into standard NTSC bandwidth. Good resolution of videotex information is especially important in Japan, where the fine detail of a kanji character must be visible for the information to be intelligible. There, moves are underway to begin HDTV broadcasts at 30 MHz a channel from the new BS-3A direct broadcast satellite. For now, few receivers are on hand for such broadcasts. But Ken Shimba of the Matsushita News Center, Secaucus, N.J., points out that it is easy to reprogram receivers that can digitally process a video signal to accept wide-band channels. "As digital receivers come on line, broadcasters and videotex operators will find it advantageous to use the wide-band capabilities inherent in DBS," he says. If a broadcaster wishes to stick with equipment that is already available in large numbers, TV-receive-only, and cable systems can be adapted to accommodate HDTV transmissions [*Electronics*, June 28, 1984, p. 98].

Although Zenith Radio Corp. will probably be the first U.S. manufacturer to bring a digital TV to market, the Glenview, Ill., firm seems to be concentrating its high-definition efforts on Z-Text, its new full-field videotex system reportedly able to store 5,000 pages, all accessible in real time. According to Gregory Woodsum, manager of videotex engineering, "One of the major defects in the world-standard VBI [vertical blanking interval] is the poor resolution of the text itself because the text must be inserted into the brief and bandwidth-constricted interval between the end of one picture field and the beginning of the next. Z-Text improves text definition by using a full-bandwidth cable channel and a full field on the TV screen." □

Additional reporting for this article was done by Charles Cohen and John Gosch

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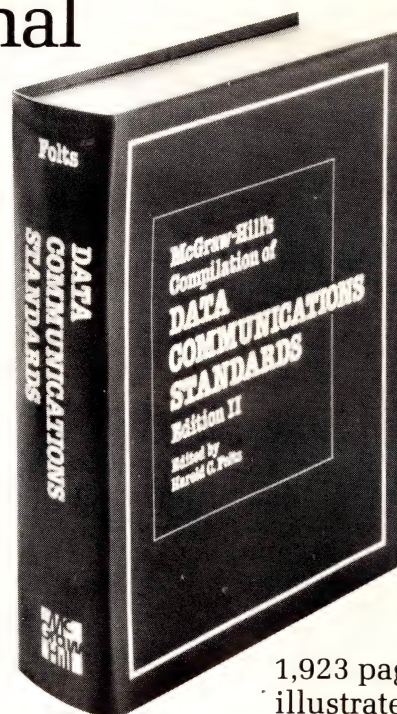
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IC QUALITY AND RELIABILITY GAIN SHARPLY

Rescreening of semiconductor devices after tests by the vendor

spots rejects in military and aerospace applications □ by Eugene R. Hnatek

Rescreening of semiconductors destined for military and aerospace systems, beyond the test measures taken by the vendors themselves, has led to a marked improvement in parts quality. Pressure for rescreening stemmed from claims such as those made by R. Adm. Henry Duff Arnold in late 1981 that "the average reject rate for semiconductors range[s] from 2% to 25% in Navy electronic systems; in the extreme, more than 50% of delivered parts have been discovered to be defective upon rescreening."

As a consequence, the Navy as well as the National Aeronautics and Space Administration require rescreening of all semiconductor devices as a specific item in their contracts. Rescreening results gathered from the Navy's Vertical Launch System (VLS) and NASA's Centaur Boost Vehicle programs show significant drops in reject rates.

Quality and the economy

Since the mid-1970s, the leading edge of integrated-circuit technology has changed rapidly. Perhaps the most dramatic change has been in circuit densities, which have gone from 4-K dynamic random-access memories to 256-K DRAMs, from 8- to 32-bit microprocessors, and to component counts approaching 1 million transistors per chip. These density improvements have been the result of major advances in IC-fabrication technology that have, for example, reduced feature sizes from 6.5 to 7 μm to a range of 2 to 2.4 μm , increased die sizes from 100 to 150 mils/side to more than 300 mils/side, and increased process complexity with a jump in mask levels of 50% to 100% for both bipolar and MOS technologies.

Leading-edge technological innovations are typically implemented first for DRAMs because of their high production volume and extreme price

sensitivities. Once these innovations are refined, they filter downward to all areas involving mature products that may be restructured, redesigned, or resteped for larger wafer sizes—or a combination of all of these—in order to decrease die size, obtain more dice per wafer, decrease the cost per die, and increase profits and inherent device-quality levels.

At the same time, users have become more concerned about inherent device quality because of higher printed-circuit-board densities, and the availability and use of dense VLSI devices fabricated with new and complex process technologies. Semiconductor device failures significantly affect a user's ability to do business in the marketplace.

Such device failures in a user's equipment can include equipment downtime, high warranty and repair costs, eventual loss of sales, and a loss of good will. In the case of military and aerospace applications, repair might not even be possible, thus putting an extremely high price tag on the cost of a device failure, even to the point of loss of life.

The world business climate and its effect on electronic

TABLE 1: FACTORS INFLUENCING SEMICONDUCTOR FAILURE

Chip- and die-related failures	Assembly- and package-related failures
Oxide faults, pinholes, breakdown	Open, shorted wires
Oxide junction contaminants, leakage	Lifted, broken wire bonds
Diffusion defects (such as spikes)	Misplaced wire bonds
Passivation defects	Multiple wire bonds
Mechanical defects in the chip (cracked die, crystal imperfections, scratched die)	Lifted chips
Design defects (mask faults)	Improperly sealed packages
Foreign materials, particles	Die attachment defect
Metalization (opens, shorts for both single- and dual-level metal)	Excessive sealing material
Electromigration	External lead defects
Polysilicon defects (single- and multi-layered)	

equipment sales has a significant influence on suppliers of military high-reliability (called hi-rel) devices. The commercial semiconductor market, and the IC market in particular, are growing at an astounding 20% to 37% annual rate whereas the hi-rel semiconductor market segment is growing at 10% to 15% per year on a much smaller base. Because of this, IC vendors have tended to concentrate on the commercial portion of their business, with limited expansion aimed at the military and aerospace market sector. In addition, manufacturing and testing of semiconductors that must meet mil spec and hi-rel requirements are far more complicated than for commercial devices and require more time, with potentially less profit.

The increased use of integrated circuits in electronic systems has been accompanied by an increased concern over IC failures. Some common causes of IC failures include: not meeting electrical specifications; damage in transit from the vendor's plant; latent defects in the parts; damage in the user's assembly process; user misapplication; and poorly or incorrectly written specifications.

As a result, more users have begun performing some type of screening operation. Today, commercial applications have just as stringent reliability requirements, if not more so, than military and aerospace applications. Consequently, it is imperative that device failures be eliminated prior to their installation in a product.

Reliability and quality

Theoretically, when an IC vendor does 100% testing of its parts, every part shipped should be good. Although component vendors normally do a reasonably good job of testing, there are still many ways that errors can be passed on to the user. These can include: all parameters on the data sheet not being tested; automatic test equipment (ATE) not being calibrated, being out of calibration, or incorrectly programmed; test operators mixing

rejected devices with good ones; improper or incorrect part marking; and vendor personnel mixing different part numbers together.

The words "reliability" and "quality" are often used interchangeably, as though they were identical facets of a product's merit. In fact, they are quite different.

Quality applies to the number of faulty devices among good ones as they arrive at the user's plant. Put another way, quality is related to the number of faulty devices that escape detection at the vendor's facility.

Reliability is measured by the percentage of parts that fail to withstand their application environment in a given period of time. Thus, reliability is quality on a time scale, and testing (or screening) compresses the time scale. Testing or stressing a component does not necessarily make it more reliable, but it affects reliability in that failures are removed based on the time compression inherent in testing. Reliability must be an inherent quality and is a function of the process being used to fabricate the device.

As a result, the more mature component technologies tend to produce the more reliable devices. The yields of a mature process are also inclined to be higher, but high yields do not necessarily mean high reliability. The extent to which devices are screened and the severity of the screening depend on the type of component, as well as the end application. As a rule, passive components tend to have lower failure rates than active ones, and simple ICs generally fare better than complex ones.

Screening sequence

Although reliability cannot be tested into the product, testing can eliminate the unreliable percentage and directly improve the reliability of the surviving population. Improved lot reliability is accomplished by compressing time in accelerated testing by using time, power, and temperature relationships.

In determining a screening sequence that is effective, it is necessary to understand the failure mechanisms of the devices to be tested. Semiconductor failures can be divided into either chip- or die-related failure modes, which are process dependent, or assembly- and package-related failure modes that result from the assembly processes listed in Table 1.

To offer some idea of the costs of replacing defective ICs, a consumer-product replacement cost at the component level may be as low as \$2; a defective IC deployed in a military system might cost the taxpayer \$1,000. A semiconductor failure in a space project could mean a \$2 million loss.

Additionally, because lead times vary from 18 to as much as 52 weeks for a given device type, procuring replacement parts may cause major program problems and impose serious delays, to the point of possibly

TABLE 2: IC SCREENING SEQUENCE FOR VERTICAL LAUNCH SYSTEM (VLS) AND CENTAUR PROGRAMS

VLS	CENTAUR
Particle-impact noise detection (PIND)	PIND
Electrical tests @ 25°C; go-no-go per applicable mil-spec slash sheet	X-ray (2 views)
Burn-in: 168 hr @ 125°C per mil-spec	Destruction physical analysis (DPA)
Electrical tests @ 25°C, -55°C, +125°C; go-no-go per applicable mil-spec slash sheet	Temperature cycle: 10 cycles, -65°C to +150°C
Remark each part	Electrical tests @ 25°C, -55°C, +125°C; read and record per applicable mil-spec slash sheet
	Burn-in: 240 hr @ 125°C per mil spec
	Constant acceleration: 30,000 gs around the Y ₁ axis
	Electrical tests @ 25°C, read and record within 96 hr after removal from burn-in
	Parametric drift calculations
	Electrical tests @ +125°C, -55°C; read and record per applicable mil-spec slash sheet

Note: Electrical tests for VLS and CENTAUR are DC, AC and functional.

missing both end-equipment-delivery deadlines and mission schedules. The latter could contribute to costs on the order of hundreds of thousands of dollars for each day the schedule is behind.

Users consider high-reliability components a necessary expense in systems whose failure in service could result in unusually high maintenance costs, production or material losses, or more important, risk to human safety. Generally speaking, any component built to conform to one or more military specifications is likely to be better made and of higher-grade material than its nearest commercial counterpart. It also would be expected to operate satisfactorily over a wider temperature range than the same nonmilitary part.

Costs more

Of course, a mil spec part is expected to cost more, sometimes substantially more, than a commercial device due to the additional attention, documentation, and traceability that must be met. The purchaser of a military-qualified component is, in effect, betting on the premise that a product made in accordance with proven methods, of carefully selected materials, and subjected to stringent tests for quality and reliability is statistically likely to outlast parts that have not been manufactured under such tightly controlled specifications.

Different screens are needed to detect different failure modes because no single screening test is sufficient to find all or even most of them. Therefore, a sequence of screens frequently is used to detect the mix of failure modes most appropriate for the end application. The most common types of tests employed in semiconductor screening for weeding out both die-related and package-related failures in a military application include: stabilization bake; temperature cycling or thermal shock; constant acceleration; hermeticity; seal or leak (fine and gross leak); particle-impact noise detection; electrical test;

burn-in; and X-ray examination.

The screening sequence depends on such factors as the device technology and design; the intended application; the expected failure, and failure modes; the vendor's history (previous experience); the user's design safety margins (called guard bands); and the cost of not testing. This calls for a judicious assessment of which screening tests to impose for a given application.

The value of device testing is a complex matter with many nuances. Simply stated, it requires evaluating the problems that would have been caused by the defective devices that were removed.

The cost of testing hinges on many variables, including the direct labor required to test the components. Factors that affect this include package size and type; generic part functions; ATE throughput (go/no-go or read-and-record testing); test temperature; specific screening tests; the complexity of burn-in or electrical testing; and labor rates of individuals involved, which could be operators, technicians, or engineers. Indirect costs of testing components include the cost of equipment used and depreciation, and overhead rates.

How current military-specified and -tested semiconductors fare when subjected to rescreening, and how the results obtained from recent rescreening programs compare with those of seven to eight years ago can be determined by examining the rescreening results of two separate programs, the Navy's Vertical Launch System (VLS) and NASA's Centaur Boost Vehicle.

In each case it was mandated or built into the program that rescreening was required, to be performed at an independent test laboratory (ITL). Table 2 lists sequence of tests for optoelectronic devices, power SCRs, digital ICs, linear ICs, diodes, transistors, and thyristors. Table 3 presents the results of the listed sequence of screens conducted during three time periods from 1981 to 1984.

A dramatic reduction in rejects has occurred during

TABLE 3: SEMICONDUCTOR SCREENING REJECTS FOR VLS PROGRAM

Chip type	Time period	Number of part types	Quantity tested	PIND	Burn-in	Extended temperature testing (25°C)	Extended temperature testing (high/low)	Visual inspection	Total (No. / %)
Digital logic	1981-82	29	4,492	247	—	77	431	—	755 / 16.8
	1982-83	31	30,333	313	—	193	1,564	7	2,077 / 6.8
	1983-84	30	27,570	133	5	530	324	20	1,012 / 3.7
Linear ICs	1981-82	18	4,025	301	—	387	295	—	983 / 24.4
	1982-83	10	12,349	682	—	108	264	0	1,054 / 8.5
	1983-84	16	14,340	323	14	160	268	4	769 / 5.4
Diodes	1981-82	31	19,548	122	—	485	46	—	653 / 3.3
	1982-83	19	54,878	97	—	167	159	2	425 / 0.8
	1983-84	23	41,005	82	75	335	939	31	1,462 / 3.6
Transistors	1981-82	15	2,665	507	—	17	45	—	569 / 21.4
	1982-83	11	7,125	942	—	209	12	—	1,163 / 16.3
	1983-84	19	7,372	414	22	98	50	17	601 / 8.2
Optoelectronic devices	1981-82	3	1,176	53	—	121	3	—	177 / 15.1
	1982-83	2	3,434	2	—	109	10	—	121 / 3.5
	1983-84	4	2,034	6	4	38	4	26	78 / 3.8
Power silicon controlled rectifier thyristors	1981-82	6	432	38	—	62	10	—	110 / 25.5
	1982-83	4	1,185	9	—	82	3	1	95 / 8.0
	1983-84	3	333	6	24	33	12	0	75 / 22.5

TABLE 4: CENTAUR SEMICONDUCTOR RESCREENING RESULTS

Chip type	Number of part types	Quantity tested	Total rejected	Percentage rejected
Digital	7	569	63	11.1%
Linear	4	1,408	125	8.9%
Diodes	31	9,043	1,168	12.9%
Transistors	13	2,056	593	28.5%

this period for digital ICs (dropping from 16.8% to 3.7%), for linear ICs (dropping from 24.4% to 5.4%), for transistors (dropping from 21.4% to 8.2%), and for optoelectronic devices (from 15.1% to 3.8%). The reject rate for diodes and power devices dropped in the second year but then increased in the third year back to the levels experienced in the first year.

Power devices, by their very nature, tend to exhibit fairly high reject rates. For all years, meaningful conclusions cannot be reached because of the small test population size. All that can be said is that the power devices retested exhibited high reject rates.

Additional requirements

The rescreening data for the Centaur Boost Vehicle is shown in Table 4. Particle-impact noise detection (PIND) testing and X-ray analysis were not performed by the vendor as part of the parts-purchased quality level. Thus, both are additional requirements imposed upon the procured material by the Centaur Program Office.

Initial electrical testing at 25°C accounted for 2.3% rejects for linear ICs and for 1.5% rejects for transistors. These were most likely marginal test escapes, probably the result of devices sitting right at the specification limit when tested by the vendor and then failing at the Viking test facility due to better ATE resolution and accuracy.

All of the rejects (743) for zener diodes under initial 25°C tests were due to temperature coefficient criteria which were imposed upon the ITL on a 100% basis. The vendor of these zener diodes is only required to perform this test on a lot-sample basis. It appears that the sample testing is indeed not effective in providing product-tested-per-MIL-SPEC requirements. In all cases, these rejects were marginal in nature and accounted for an 8.2% reject rate for the diode category.

Electrical testing and drift calculations at 25°C after high-temperature reverse-bias (HTRB) burn-in for discrete semiconductors presents a further source of rejects. Devices subjected to HTRB should not exhibit electrical-test rejects since this screening was already accomplished by the vendor. During burn-in, a number of power transistors failed. These were the only catastrophic failures during the screening sequence for both programs.

All of the devices were powered in accordance with the military specifications, and chamber-temperature controlled, so that the junction temperature would not be exceeded. A parts analysis revealed the underlying cause of failure to be poor die attachment, resulting in the formation of hot spots, and thus destroying the devices.

After burn-in, all device categories exhibited rejects. It is interesting to note that discrete semiconductors continued to fail during these tests, although they are repetitions of the vendor's tests. The process stability of these devices may very well be questioned. For ICs, especially linear ICs, about as many devices were rejected at this final electrical test sequence (over three temperatures) as were rejected at 25°C prior to burn-in, indicating the ability of the burn-

in screen to cull potential defects. Here, as for the VLS program, all electrical test rejects were caused by parametric drift. There were no catastrophic failures.

Of particular concern is the number of seal rejects, those failing the hermeticity test, which is the last 100% screen performed. Since it takes place after the temperature cycling, constant acceleration, and burn-in stress screens, it locates defects in the package-sealing system stressed by the screens themselves. Poor package-assembly techniques on the part of the vendors should be the responsibility of the vendors themselves to locate and correct; rescreening is the only alternative solution.

The overall reject rates shown are for exhaustive electrical tests performed on a 100% basis in strict compliance with the appropriate mil specs at extreme temperatures. Some rational judgment must be used in interpreting these numbers in regard to the part derating and application in a given system.

For one thing, these reject rates do not predict product survival; they are only an indicator of the parts' compliance with the specifications. Most system designs guard-band the published electrical limits and do not concurrently operate the part at extremes of power-supply voltage, temperature, and data-sheet limits. Thus, if a part fails a certain electrical parameter, it does not mean that the part will not work at all in a given application.

Prudent judgment

Some prudent judgment must be exercised in assessing the results of this or any screening program in regard to rejects, what they mean, and their relationship to the intended application. Also, any rejects from screening tests not performed by the vendor, or called out in the part-purchase order, cannot be used to rate the quality of the product, since they are clearly beyond the scope of the quality of the procured parts.

The rescreening test results show a significant reduction in reject rates for similar generic devices used in the VLS and Centaur Programs, as compared with rescreening performed seven to eight years ago. This leads to the conclusion that the inherent quality level of current semiconductors is higher than that obtained previously. Furthermore, for the programs studied, it also indicates that component rescreening is necessary, because it identifies rejected parts that might cause systems problems later on, and is an effective means of weeding out device failures. □

Eugene Hnatek is a test engineer at the Viking Laboratories, Inc., Mountain View, Calif.

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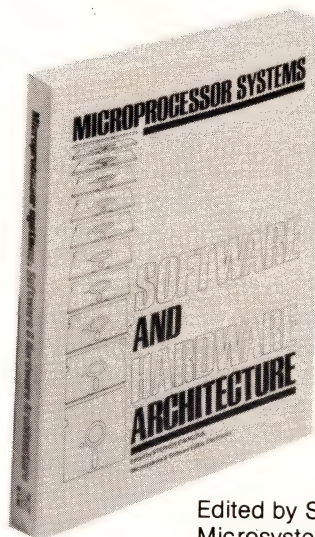
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EVALUATING NETWORK SOLUTIONS

The successful design of personal computer networks hinges on choosing the right network server for the system □ by Mark Hurst

The explosive growth of personal computing in the workplace and the increasing sophistication of local networks are forcing systems developers to address the difficult chore of coordinating information sharing and networking among personal computers with dissimilar native operating systems. The mere fact that two machines connect to the same hard disk does not guarantee meaningful and foolproof interaction. With sophisticated network-management software, however, a network of microcomputers and shared peripherals can be endowed with all the advantages of a traditional time-sharing system, at a cost that will make it attractive to a wide range of end users.

But this level of sophistication has been slowed by the lack of a set of comprehensive standards for network organization. This is so despite the groundwork that was laid by the International Organization for Standardization when it created a basis for standardizing communications systems—the open-system interconnection model. The OSI model defines seven layers of communication protocols, with specific functions isolated at each level (Fig. 1).

Seven-layer model

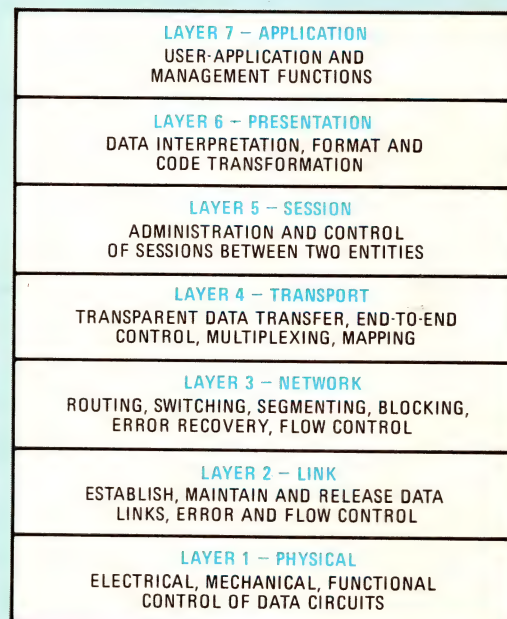
The bottom layer of the model defines the mechanical connections that tie personal computers together in a network. This includes electrical requirements for establishing and terminating transfers of information between nodes.

The second layer, the data-link layer, defines procedures and control protocols for operating the communication lines. It offers a means of detecting and correcting message errors, which enables the model's higher layers to direct the circuits within the bottom layer. The link layer also incorporates the network topology, which defines how the nodes are tied together. For example, a network can have a star, ring, or bus topology (see "Stars, rings, and other things," facing page).

Next in the OSI hierarchy is the network layer, which determines how data is transferred between personal computers. The Institute of Electrical and Electronics Engineers' 802 committee developed the standards for

this layer and the two bottom layers. To date, all network vendors conform to the OSI model and IEEE 802 standards through the first three levels; it is the remaining four levels that still vary widely among vendors and cause a great deal of confusion for the potential user of a local net.

The upper four layers define the way intelligent interactions take place between applications, enforce the rules for information exchange between personal computers of similar and different designs, and manage end-to-end delivery of information within and between networks. These layers also ensure data integrity, allow network management and control, and provide the user with an



1. Seven layers. The open-system interconnection model of the International Organization for Standardization defines seven layers of communications protocols. But designing a user-friendly network means putting the functions of all layers into the applications layer.

interface to the network's services.

Until recently, network vendors were content to provide a proprietary operating system to handle the functions in the upper layers of the OSI model adopted by the ISO, which meant that the system features were unique. For example, an Omninet, made by Corvus Systems Inc., San Jose, Calif., is not only physically different from an EtherSeries network, made by 3Com Corp., Mountain View, Calif., but the methods of managing the network differ as well. For the most part, the user interacts with the uppermost layer, called the applications layer. This layer comprises the languages, tools (such as program development aids, file managers, and personal productivity tools), data-base-management systems, and concurrent multiuser applications. All these functions rely on the lower layers to perform the details of communications and network management.

The challenge that the designer faces is to funnel all the network's functions into the applications layer. Before this can happen, though, the designer must fully

define the network's architecture.

To assess what type of architecture will work best, it is necessary to first weigh such factors as peripheral allocation, extended services, ease of use, and the level of information sharing that will be required of the system. The physical network architecture—that is, the hardware interfaces and transmission protocols defined in the lower levels of the OSI model—is not the critical element in determining the depth or breadth of network services, although it does affect the network's response time. Information sharing and availability of services should be given greater weight in evaluating possible architectures, but it is important to remember that if dissimilar microcomputers are to be networked, local-net choices will be restricted because heterogeneous machines cannot readily communicate.

Any analysis must begin with a pragmatic assessment of both the present and expected requirements of peripheral devices such as hard-disk storage media, plotters, and printers. Because peripheral equipment is costly if it

Stars, rings, and other things

In a star topology, personal computers are joined at a single point and all network traffic is routed through the central node. The central node in a star is relatively easy to implement and thus inexpensive in terms of both hardware and software. Because each node has a private link to the central node, the aggregate throughput of data in a star is greater than in many other network topologies. The power of the central node dictates the size and capacity of the network. This node, however, is the critical link within the system: if the node goes down, it takes the entire system with it.

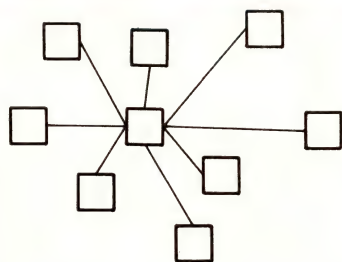
Ring topologies are connected by point-to-point links in an unbroken circle. Rings often employ a signal contention scheme called token passing to avoid conflicting demands on the network. It works as follows: a bit pattern, called a token, is circulated to each node on the ring. When a personal computer grabs the token, it alone has the right to transmit data before it passes the token along to the next computer. The wiring required to add more computers to the network can be costly: without expensive bypass components, a failure on any part of the network will cause the system to stop.

In a bus topology, personal computers tap into a single physical channel. Like the ring, messages on the bus are broadcast to all personal computers, but because those

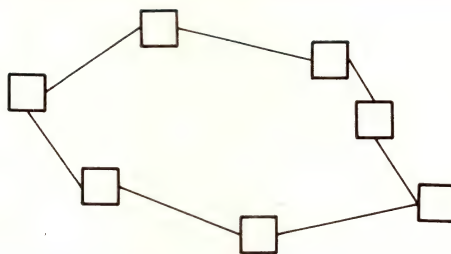
messages do not have to be repeated, there are no retransmission delays. Consequently, it runs faster than a ring. Bus networks can also be easily configured for most physical layouts because the cable can be easily strung through a building's plenum area or raceway. The passive role of the nodes on the bus allows the network to keep functioning when a single point fails. Bus-type networks usually employ an access scheme known as carrier-sense multiple access with collision detection (CSMA/CD) or collision avoidance (CSMA/CA), or a token-passing scheme.

There are a plethora of options available to physically link the nodes. Today, however, most links are accomplished using either baseband or broadband cable. Microwave, radio, or satellite channels are finding increasing use in newer networking designs as well. It is important to point out that selecting the right transmission scheme depends less on selecting a media than it does on choosing a proper data rate. Any design must ensure that the channel can pump data at the required rate without introducing an unacceptable amount of errors, though still be able to propagate a signal without attenuation.

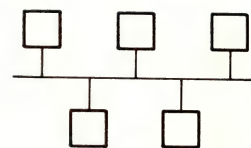
The set up time required to create a virtual circuit—which includes the signaling mechanism and delays for setup and breaking—is also an important factor if the network doesn't have a point-to-point circuit.



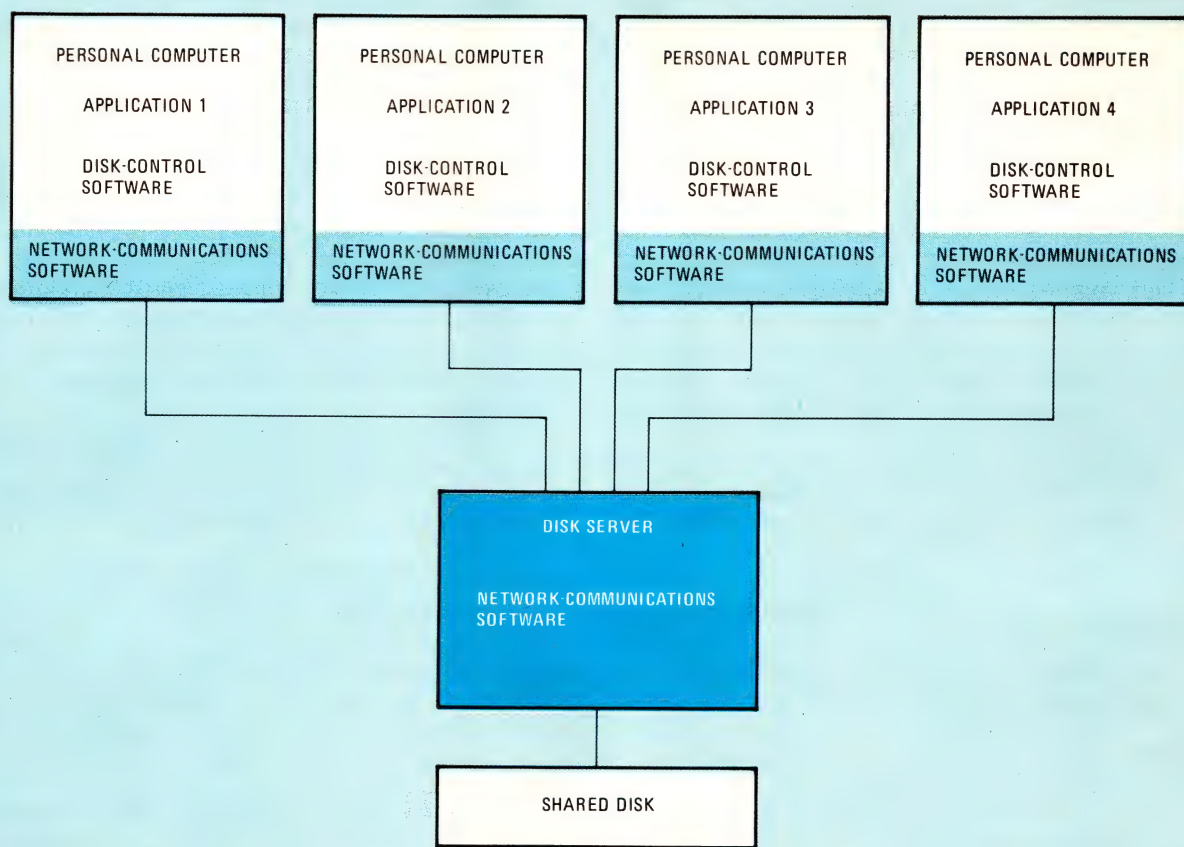
STAR



RING



BUS



2. Disk server. Though it is relatively simple to implement and provides some centralized control over the shared disk, the intelligent disk server lacks a strong file control mechanism. This leaves the network file structure open to corruption.

must be duplicated for each computer, sharing such devices becomes a significant consideration in networking computers, so orderly access to the network's peripheral devices should be the minimum requirement of any networking software design.

Special extended services are often a by-product of a centrally controlled network. Print spooling, hierarchical or tree-structured directories, electronic mail, and interactive multiuser accounting are some of the services that can greatly enhance the working environment.

An easy-to-use network is crucial to the success of a design in the marketplace, but it also requires extensive development, which significantly increases the network's initial cost. A less complex network design may be sufficient to support a simple application, particularly one that does not require multiuser access to shared data bases. If any shortcuts are taken in this area, the results can be disastrous: it is important to target the product carefully and to know precisely what niche it will fill in the marketplace. If the product is targeted at the growing corporate market for networks, then a greater up-front investment for a more sophisticated design may be in order.

The most important consideration in designing a network architecture is what level of information sharing will be required. Sophisticated, high-level mechanisms that allow coordinated sharing of information are the

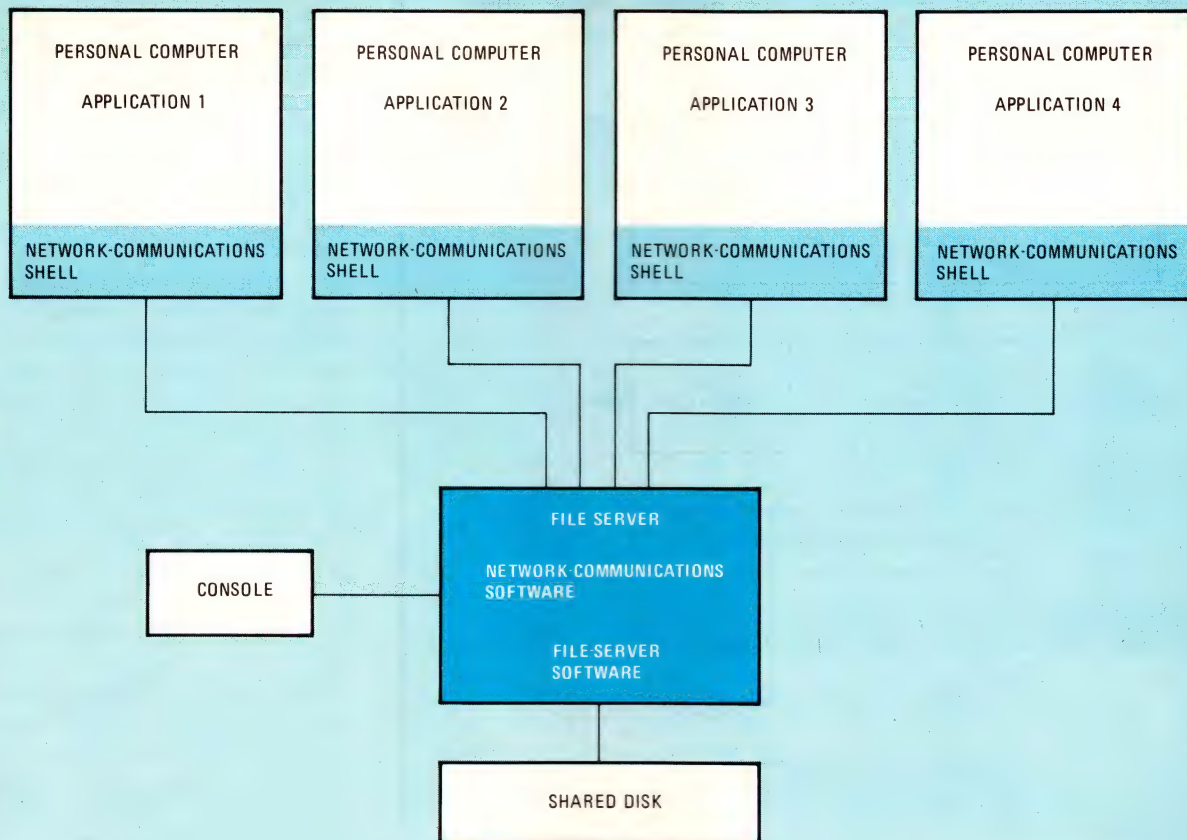
backbone of any serious multiuser application. Uncontrolled concurrent access to the same data inevitably leads to loss of data and impaired data integrity and security. A network should provide both easy access and tight control to coordinate data sharing.

Centralized network control

Among a plethora of possibilities, the most reliable personal computer networks are designed using centralized network control where a data-management computer becomes the network's logical hub. A centralized network manager is responsible for managing data files and hardware resources, maintaining data security, and handling intercomputer communication and synchronization. This approach gives added control and reduces processing time, compared with a decentralized network.

What's more, a decentralized approach has some inherent drawbacks, not the least of which is that each computer requires a complete set of network-coordinating software. Because of the complexity of building an asynchronous decentralized network, extensive additions to each microcomputer's single-user operating system are necessary; this increases the processing overhead and degrades each unit's local performance.

In this environment, ensuring data security and integrity is nearly impossible because the data is dispersed. The host personal computer must protect any confidential or



3. File server. Because the file server places all the responsibility for disk management in a central network manager, several personal computers can gain full access to information in the same directory without mutual interference.

restricted data, making it necessary to program in any additional computers that require access. Furthermore, security mechanisms could be easily bypassed or ignored, simply by running the personal computer in its native, stand-alone mode. In short, a decentralized network of personal computers eventually lends itself to security breakdowns.

Data file management

Centralizing the network's control functions means designing an operating system using either a disk server or a file server to give personal computers shared access to a hard disk. A simple disk server merely partitions the disk into a set of independent volumes, or virtual floppy disks; one volume can be allocated to only one computer at a time. Each computer is then directly responsible for managing the data directories and files for its volume. This approach requires very little intelligence on the part of the central network manager and shifts the overhead for controlling the volume from the manager to the computer. Moreover, this scheme usually lacks data security and integrity.

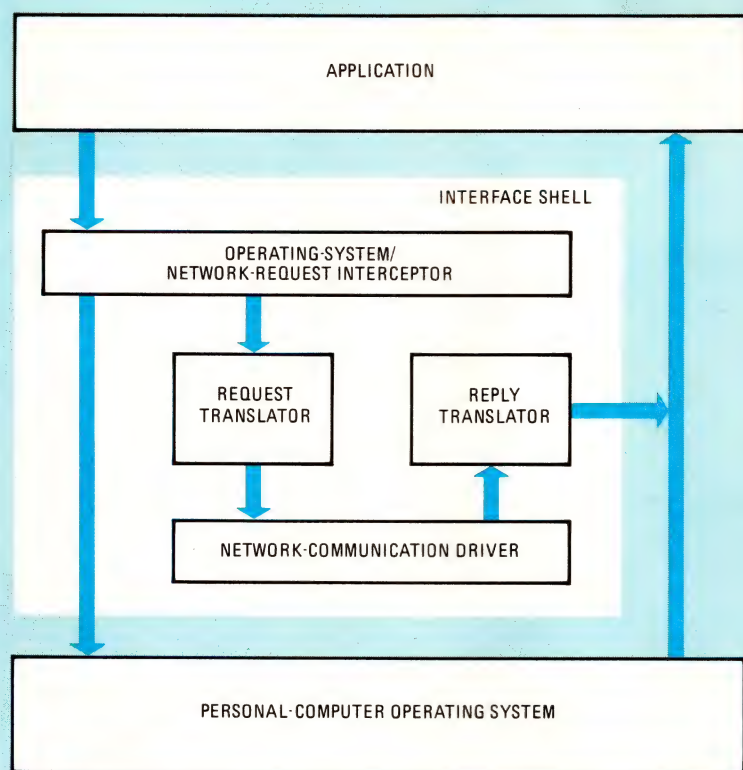
A simple disk server is easy to implement and thus is attractive for applications that need a cost-effective approach to sharing peripheral devices. However, concurrent sharing of information is virtually impossible with a simple disk server, and it precludes the use of sophisticated

applications software. In addition, the simplicity of controlling software may limit power and flexibility in accessing the network peripherals as well as restrict the addition of such extended features as electronic mail.

With an intelligent disk server, networked personal computers can request and secure access to centralized disk volumes, printers, plotters, and tape drives (Fig. 2). Using this approach, designers can build in security by controlling which computer or user can gain access to any volume. For example, a user can lock out other users and retain all update privileges (usually at the volume level) while still allowing other users inquiry-only privileges. Semaphore mechanisms built into more advanced disk servers permit file sharing.

Unfortunately, when each computer is responsible for managing its own disk-space allocation, the network file system is still vulnerable to corruption. Another problem with this approach is that developing advanced applications tends to be very time-consuming. Such limitations restrict the ability to change as network requirements grow.

A file server is the most sophisticated solution to data file management because it relieves the networked personal computers of all disk-management responsibilities. Thus it gives the networked computers access to information in the same directory areas without any danger of their interfering with each other (Fig. 3). The network



manager maintains a complete logical file system of its own style and structure. In addition, it provides advanced mechanisms to support concurrent file updating. Although it is more difficult and costly to implement, it offers comprehensive control of information sharing and can be built with many of the extended features that users are demanding.

Supporting dissimilar personal computers

Designing a network using a file server means that even among heterogeneous personal computers, centralized control of network services can be enforced through a set of standard software interfaces. Interoperability is easiest to implement using an interface shell: an 8-to-16-K-byte chunk of software residing in each personal computer. The shell translates the computer's native-operating-system requests into functionally equivalent, high-level network requests (Fig. 4). Similarly, the shell receives and interprets any replies from the file server, rendering them into a form recognizable by the particular computer's operating system.

By using a network interface shell, each computer can maintain its individual view of the network environment. To an Apple II, the world is an extension of Apple II; to an IBM Personal Computer running MS-DOS, the network appears as an extension of MS-DOS. The interface shell performs the translation step between the personal computer's native operating system and the network environment. Because of this transparency, most single-user software is able to run without modification in the network environment; the file server becomes, in effect, a superset of its various microcomputer operating systems.

4. Shell games. Using an interface shell, heterogeneous personal computers can share the same network. The interface shell is a set of software that translates the personal computer's native operating system into functionally equivalent high-level network requests.

File read/write requests native to a computer's operating system are mapped to a corresponding set of network requests.

To create a true multiuser network, the designer should consider building a locking feature so that concurrent sharing of data can occur. Most often, this is done using programming functions, or primitives, which enable an application to lock out other users. But primitives that allow applications to synchronize concurrent access are not enough; maintaining the integrity of the shared disk's directory and file system is also an essential network task.

Providing high-level data management services begins with the designation of a personal computer with hard-disk storage as the network manager. The network processor must have sufficient power to serve

the intended environment with adequate response time. For networks involving only a few active users, an 8086 or 8088 can be made to perform quite well. Networks with heavier user requirements will need processors with the power of an 80186 or MC68000.

The file server software running on the network manager must be designed to coordinate the network's multiuser file system and peripheral devices. Because a general-purpose operating system would adversely affect response time, a special purpose multitasking operating system should be developed for the foundation of the file server software. Even though it tends to be more complex than the operating system for a disk server, it pays for itself in end-user satisfaction.

Using this approach, the file server relieves the computers of detailed file and directory manipulation. A computer can request only high-level operations, such as opening a file, reading any number of bytes starting at an arbitrary point, and deleting a file. Computers can never destroy the integrity of the network file system. High-level, centralized control of the file system allows the file server to arbitrate such difficult tasks as extending shared data files.

In addition to information processing, the file server should provide various network services such as inter-computer message processing, print spooling, and system utilities for network security and directory management. A centralized file server can offer complete control over file directory operations and thus readily maintain directory integrity despite deluges of user requests. □

The author is with Novell Inc., Orem, Utah.

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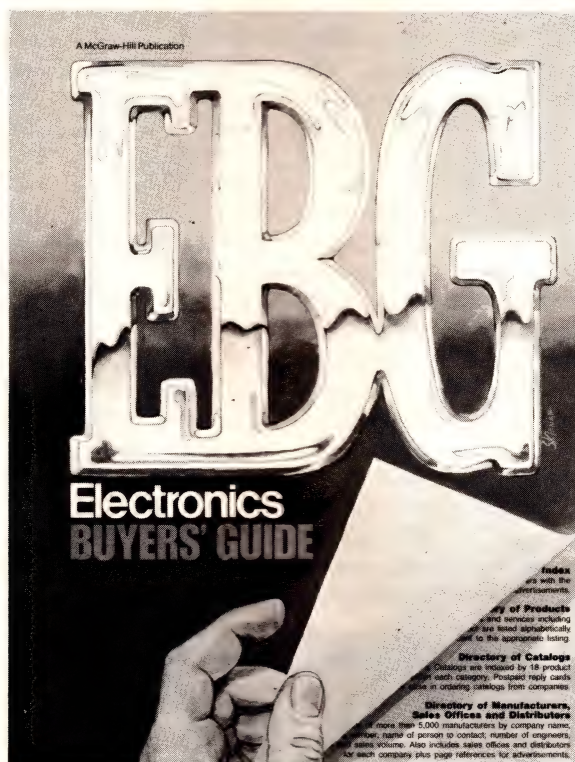
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SINGLE SOURCE FILLS ALL LAYERS OF LOCAL NETS

Intelligent controller boards, protocol-software packages, and a development tool kit give systems integrators flexibility in building Ethernets □ *by Steve Zollo*

One-stop shopping for systems integrators building Ethernets is Interlan Inc.'s product strategy. With the firm's latest round of products, systems designers can build Ethernets that satisfy any or all of the seven levels in the open-systems interconnection model of the International Organization for Standardization. The new offerings include link-level controller boards (meeting the two lowest levels, physical and link) for IBM Corp. Personal Computers, which join the company's link-level controllers for Unibus-, Q-bus-, and Multibus-based systems, as well as computers from Data General Corp. Also added is a line of intelligent controller boards—satisfying levels one through four of the OSI model—and network file-server protocols that can serve designers working with either the link-level or intelligent boards.

The variety of Interlan's products, which can be purchased together or separately, allows integrators to provide completely networked systems or let end users add the applications programs. Using the intelligent controller boards, integrators can provide complete Ethernets;

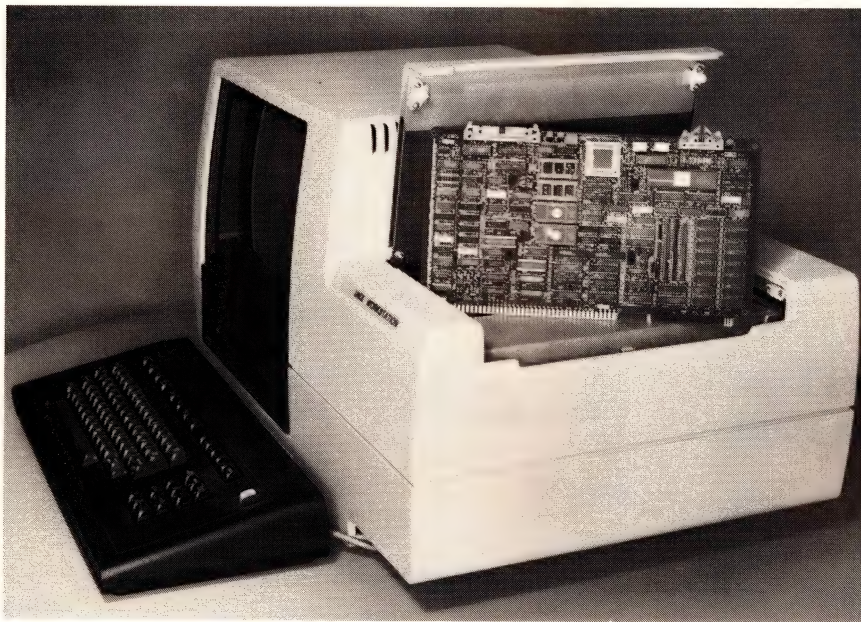
using the link-level boards, they can provide either complete Ethernets of lower performance (because the host computer will do some of the protocol handling) or partial Ethernets, in which end users provide some of the software support. "It's kind of like picking from a menu in a Chinese restaurant," jokes Jim Hertenstein, Interlan's director of product planning and management.

The three intelligent boards—the NP100 for Unibus, NP200 for Q-bus, and NP300 for Multibus—connect their respective host systems to an Ethernet. Featuring an on-board 80186 processor with the company's NCX100 network communications executive, the boards can support all seven layers of the OSI reference model. As a result, the burden of executing CPU-intensive network-communications protocols is off-loaded from the host central processing unit.

The boards' CPU operates at 8 MHz, has a 16-bit internal and external data bus, and implements instruction prefetch for maximum performance. The highly integrated 80186 features three hardware functions used extensively by the network boards' real-time multitasking communications executive: three 16-bit programmable interval timers, two direct-memory-access controllers, and a programmable interrupt controller.

In addition, the boards contain 128-K bytes of dynamic random-access memory; expansion to 256-K bytes is optional. The memory is dual-ported for interleaving by the 80186 and the 82586 Ethernet communications controller that allows efficient on-board handling of packet-data structures. The dual-ported RAM places no wait states on the 80186 processor. The 82586 implements the carrier-sensing multiple-access/collision-detection data-link procedures for transmitting and receiving packets at 10 Mb/s.

The intelligent controller boards



also have 16-K bytes of erasable programmable read-only memory containing comprehensive power-up self-testing diagnostics and a program-boot requester. Four spare 28-pin sockets support the addition of 32-K-by-8-bit EPROMs or 8-K-by-8-bit electrically erasable PROMs.

Serving the boards are two software options. One, the XNS ITP, for Xerox Network Systems Internet Transport Protocols, is a software package that provides higher-level protocol support for the intelligent boards. The package consists of an XNS ITP protocol-software module resident on the board and a set of host-resident software routines. The module implements the XNS ITP specification. These protocols, designed for use on an Ethernet, offer high-bandwidth communications and a full set of transport-level services.

The second protocol-software package, the DOD IP/TCP, provides a compatible implementation of the Department of Defense's Internet Protocol and Transmission Control Protocol. The package consists of an IP/TCP software module resident on the intelligent controller boards and a set of host-resident routines.

Both packages are members of Interlan's NS7400 network-file-server protocol family. The NS7400 protocols provide a means for sharing disk-based information among the users of the most popular computer systems, including Digital Equipment Corp. VAX computers running under VMS, Unix System V-based computers, and MS-DOS-based systems. To build IBM PC networks, integrators can use the NI5010 link-level controller board along with host-resident protocols—the NS7490 NFS/MS-DOS member of the NS7400 family—for satisfying the higher layers of the OSI model.

Rounding out the introductions, Interlan is making available a protocol-development tool kit with which users may write protocols. With versions that support VMS, RSX-11M/M+, or Unix 4.2 BSD hosts, the tool kit is powerful enough to implement higher-level application protocols, or it can be used to write specialized transport-level protocols when working with the intelligent controller boards.

The intelligent controller boards, available in the fourth quarter with the XNS protocols and early next year with the IP/TCP protocols, are priced at \$4,290 for the Unibus version and \$2,690 for either the Q-bus or Multibus models. Any version of the tool kit, available in the fourth quarter, will sell for \$2,000. The IBM PC networking card sells for \$775 with the on-board transceiver or for \$625 without it; both will be available next month, their manufacturer says.

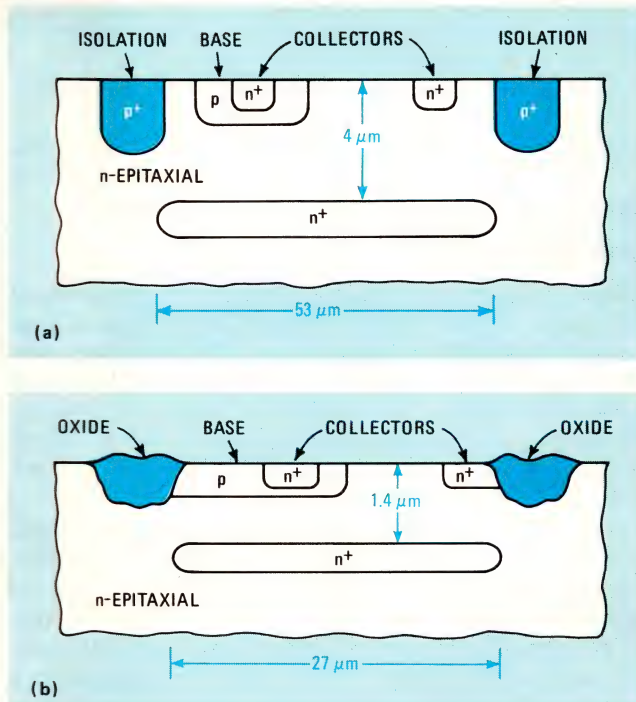
Interlan Inc., 3 Lyberty Way, Westford, Mass. 01886.

Phone (617) 692-1909

[Circle 338]

With oxide-isolation process, PLAs switch at 15 ns

Speed and flexibility make programmable logic arrays a popular semicustom replacement for TTL circuits in high-performance computers. Already, junction-isolated PLAs are replacing 25-ns Schottky TTL in graphics processors, error-correction modules, and dynamic-memory



Speedy. Rather than having cells isolated with a diffused p+ layer (a), the PLA's oxide-isolated cells (b) are only half as wide and a third as deep, allowing for faster switching. National Semiconductor's oxide-isolation process was derived from its high-speed oxide process used for ECL memories, modified for higher breakdown voltage.

controllers. Now, National Semiconductor has developed an oxide-isolation process that, together with a modified circuit design, lowers PLA switching speeds to 15 ns, which makes PLAs a suitable replacement for advanced Schottky chips.

PLAs can save as many as 10 chips in such applications as interfacing a microprocessor to a dynamic random-access memory, says National's strategic marketing manager, Joseph Vithayathil. With microprocessors that operate at 10 MHz and above, the memory controllers need fast PLAs for chip selection. The faster the selection signal, the slower the memory can be, Vithayathil points out. Fast PLAs can also perform handshaking in high-end (20-MHz) graphics processors.

National's PLAs are fabricated with a process derived from the firm's emitter-coupled-logic memory parts but modified for higher breakdown voltages. Like the RAM circuits, the PLAs are implanted rather than diffused. The cells' width is 27 μm, compared with 53 μm for typical junction-isolated PLAs, and the depth from the surface to the buried n+ layer is 1.4 μm, rather than 4 μm. An oxide well takes the place of the p+ region used in junction-isolated circuits.

The new circuits are labeled the 16L8B, the 16R8B, the 16R6B, and the 16R4B. The numerals refer to inputs and outputs, the L to an active low output, and the R to the presence of a resistor; the B identifies the PLAs as members of the oxide-isolated family.

National has samples available now and expects to have the circuits in volume production in a couple of

months. The PLAs are priced at \$11.50 in quantities of 100 pieces or more.

National Semiconductor, 2900 Semiconductor Dr., Santa Clara, Calif. 95051.

Phone (408) 721-5000

[Circle 339]

Dense gate array boasts

500-ps gate delays

Able to support emitter-coupled logic, TTL, or combined ECL/TTL, Applied Micro Circuits' Q3500 series of logic arrays offers the equivalent of up to 3,500 gates and operates with a 500-ps gate delay. The bipolar chip's power consumption is a moderate 3.5 W, or 1 mW per equivalent gate. In some cases, gate delays can be as low as 275 ps and power consumption as low as 0.7 mW/gate.

An extensive small- and medium-scale integration macrocell logic library is provided for use with the Q35005, the first array in the Q3500 series, which has been designed for military and commercial applications in computers, peripherals, and test, instrumentation, and communications equipment. "Using AMCC's building-block concept, MSI macros spanning multiple internal logic cells have been created," says Jonathan Yu, the firm's vice president of operations. "Making use of an average of 95% of the available devices, our macros permit these high-performance logic arrays to approach densities previously only attainable with standard cells."

Designs using the Q3500 macro library will be supported on the Tegas logic simulator and on Daisy, Mentor, and Valid Logic engineering work stations. Proprietary AMCC software supports fully automatic layout of the Q35005 gate array. This software can be ported to a variety of computers for customers with multiple design requirements.

Unlike other high-performance arrays that dissipate 8 to 12 W, the Q35005 consumes only 3 to 4 W. The reason, the company says, is special circuitry and a programmable speed/power feature that is built into the input/output and internal cells. Thus high-speed macros can be selected for critical paths, and standard or low-power macros can be used for the remaining circuitry. This, in effect, places the speed and power where it is needed. For example, the standard Q35005 equivalent gate delay is 500 ps and the high-speed version of the same macro has an equivalent-gate delay of 350 ps for a 25% improvement. Selected macros can be implemented with a 275-ps equivalent-gate delay, a 45% improvement over standard. This speed/power programmability feature is also available in the I/O cells.

The Q35005, in a 3- μ m oxide-isolated dual-metal process, contains two basic cell types: the logic cell and the I/O cell. The chip's core is an array of logic cells configured as 22 rows by 11 columns. These cells implement logic functions ranging from simple gates to complex functions like multipliers. With multiple logic cells, highly efficient MSI macros, such as a 10-bit counter or an 8-bit arithmetic and logic unit, can be formed.

Liberal allocation of routing channels enables logic-cell

utilization of up to 95% with automatic layout. Surrounding the array are 120 universal I/O cells distributed evenly on four sides. These cells have built-in buffering as well as ECL/TTL translators to interface externally to both TTL and ECL circuitry, eliminating the need for power-hungry and space-consuming external translators.

The Q35005 comes in a variety of packages, including leaded and leadless chip carriers, ceramic dual in-line packages, and pin-grid arrays. The company is taking limited orders now and expects to deliver in 90 to 120 days. Prices vary according to the level of the customer's involvement, complexity, packaging, and the number of parts ordered.

Applied Micro Circuits Corp., 5502 Oberlin Dr., San Diego, Calif. 92121.

Phone (619) 450-9333

[Circle 340]

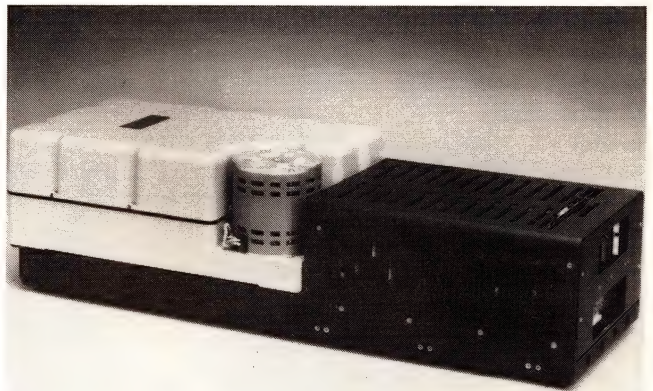
RAM-based drive can read, write on four surfaces

Called a PRAM Winchester disk drive, the MVP212 is a parallel random-access memory that contains a total of 212 megabytes of unformatted storage through eight data surfaces broken into two sets of four parallel read/write channels. Each surface of the MVP212 contains 20,160 bytes/track and 823 cylinders.

At any given time, any read/write combination may occur on four different surfaces, greatly increasing storage and retrieval time. The PRAM consists of two assemblies: a mechanical unit and an electronics module. The mechanical unit is a sealed head-disk assembly and contains five disks, eight heads, and rotary voice-coil positioner. Each head has a dedicated amplifier to minimize noise. Access times are 5 ms track-to-track and 38 ms average.

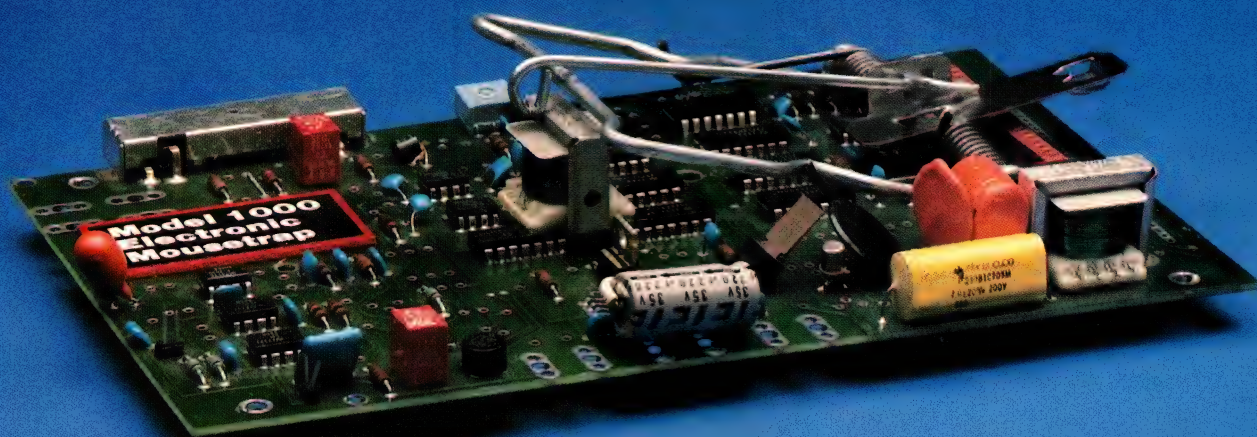
The Z80A-based electronics module consists of printed-circuit cards containing power amplifier, servo tachometer, microprocessor control, input/output, and four sets of read/write circuit boards. The system has a Storage-Module-Drive interface and boasts a transfer rate of 9.67 MHz/channel. Using four channels, the data rate is specified at 38.6 MHz.

According to the company, the SMD interface allows



**“If you make a better mousetrap,
the world will make
a beaten path to your door.”**

Ralph Waldo Emerson, 1855



**“If you design a better mousetrap,
the world won’t necessarily
make a beaten path to your door.”**

ElectronicsWeek, 1984

In the electronic Eighties industry needs better decisions, not just better designs.

Electronics, the world's most dynamic industry, is changing. And Electronics, the magazine that covers the industry, has been changing right along with it.

Ralph Waldo Emerson was wrong.

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More disasters to come?

The bankruptcy of Osborne, and RCA's \$580-million videodisc write-off are just the tip of the iceberg. More possible disasters lie hidden in the future.

And they can only be prevented by decision makers who, regardless of discipline, possess the most complete, accurate and current industry information available.

This is the
last issue of
Electronics.

JULY 12, 1984

MICROCOMPUTER WORLD NERVOUSLY AWAITS IBM'S PC II/83

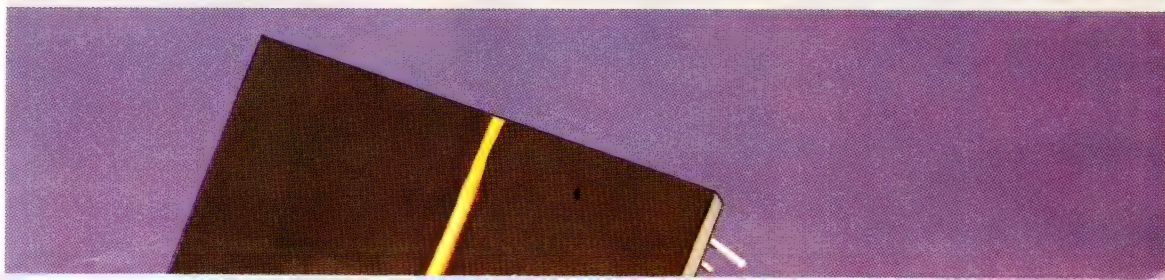
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a daisy chain of up to eight PRAM disk drives for a total of 1,056 megabytes. Available 45 days after ordering, the MVP212 sells for \$7,500 in large quantities.

MegaVault, 6431 Independence Ave., Woodland Hills, Calif. 91367. Phone (818) 884-7300 [Circle 342]

Data-base system has visual programming tools

Ingres/CS Version 1.0, a version of the popular relational data-base management system for 32-bit microcomputers, is now integrated with an English-like data-base language and a set of forms-based visual programming tools. Thus designers can develop multiuser applications without conventional programming.

Particularly well-suited for work stations and multiuser microcomputer systems running Unix, Ingres/CS includes three visual programming tools: Ingres/Query, Ingres/Forms, and Ingres/Reports. With the query-by-forms tool, users can express queries and perform transactions by filling in fields on a form. With the forms editor, the user can interactively define, create, and edit forms for Ingres/Query. With the report-by-forms tool, users can create production reports or other types of reports in Ingres/CS data bases.

To run the system requires a minimum of 1 megabyte of main memory, 20 megabytes of hard-disk storage, and the Unix System V operating system. Through *Equal/C*—embedded *Quel* for the C programming language—applications builders can integrate the data-base access and forms control with programs written in C.

The company says the new software is available now. A single license for the Ingres/CS relational DBMS sells for \$40,000 for use on a VAX 11/780 or 11/750 and for \$20,000 for use on a VAX 11/730 or 11/725.

Relational Technology Inc., 2855 Telegraph Ave., Berkeley, Calif. 94705. Phone (415) 845-1700 [Circle 343]

Test-procedure generator lets novices write programs

With the **Tek Ez-Test**, test engineers and electronics engineers can create software for their test systems without learning a test program language. Two software components, the test-procedure generator and the translator, are included. Loaded in a 4041 system controller, the test-procedure generator monitors all programmable in-

struments over an IEEE-488 interface bus. Coding bugs are eliminated because the operator verifies proper execution of each manual test step before the data is stored.

The translator program is then used to convert the verified test-procedure-generator program into a 4041 Basic program that recreates the manual test procedure. The translated program is fast, memory-efficient, and can be modified easily, the company claims. The system accepts data from any standard IEEE-488 programmable test and measurement instrument that features primary addressing and ASCII commands.

Up to 28 instruments can be supported when the 4041's optional second port is included in the system configuration. Delivered two weeks after receipt of order, the Tek Ez-Test sells for \$500.

Tektronix Inc., P.O. Box 500, Beaverton, Ore. 97077.

Phone (503) 644-0161

[Circle 345]

Rechargeable battery backs up memory systems

Intended as a memory-backup power supply for computer systems, microprocessor controls, and single-chip microcomputers, the **Circuit Guard 3.6** is a rechargeable nickel cadmium battery rated at a nominal 3.6 V dc. It is available in a standard-temperature or a high-temperature cell.

Featuring a capacity of 100 mA-h, the battery is pin-for-pin compatible with General Electric's Data Sentry, Matsushita's Memory Mount, and other systems. It is board-mountable, as its pins are compatible with dual in-line-packages, and it comes sealed in a solvent-resistant plastic case. Pricing has yet to be set.

Telecommunication Devices Inc., 2320 Wisconsin Ave., Downers Grove, Ill. 60515.

Phone (312) 971-3460

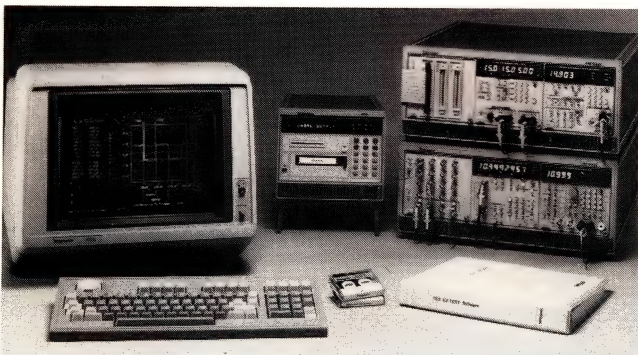
[Circle 372]



Business system offers communications, networking

An entry-level business system for commercial data processing, distributed data processing, and office automation, the **VS 15 virtual memory computer** has up to 1 megabyte of main memory, support for up to 10 users, and remote diagnostics. The system's cabinet can hold a single 76-megabyte or one or two 33-megabyte disk drives.

Sixteen ports are available for work stations and peripherals and four ports for telecommunications equipment. The VS 15 supports, among others, 3271 bisynchronous protocols, 3274 Systems Network Architecture/Synchronous Data Link Control protocols, and teletype protocols for interactive asynchronous communications.



A basic system consists of a central processor with 256-K bytes of main memory, the VS/OS proprietary operating system and a remote diagnostics facility, a 5¼-in. 33-megabyte Winchester disk drive, and a 5¼-in. 360-K-byte floppy-disk drive. Available now, the basic system lists for \$13,500.

Wang Laboratories Inc., 1 Industrial Ave., Lowell, Mass. 01851.
Phone (617) 250-5050 [Circle 349]

32-bit computer's CPU cards are available separately

The Universe 2203 is a 32-bit microcomputer based on the 12.5-MHz Motorola 68000 microprocessor. The VMEbus system has 2 megabytes of main memory and is equipped with a built-in Winchester disk with 35 megabytes of formatted storage. The 2203's two-board central processing unit, the VCP2000, is available separately for original-equipment manufacturers. It has a 4-K-byte cache memory and includes four serial ports.

A local network, UniverseNet, allows the 2203 to exchange data and files with other Universe computers as well as with systems from other manufacturers. UniverseNet consists of three components: an IEEE-802 local-net interface, network software, and five applications packages. With the network, users can exchange data files, send mail, and share resources from Universe systems or from other manufacturer's systems using nonproprietary protocols.

The Universe 2203 with 512-K bytes of main memory, 35-megabyte disk, and streaming-tape backup carries a price tag of \$16,900 and is available now. The system's central processing unit, VCP2000 card set, lists for \$4,000. The UniverseNet package lists for \$1,500. All will be available this fall.

Charles River Data Systems Inc., 983 Concord St., Framingham, Mass. 01701. Phone (617) 626-1000 [Circle 395]



Nonimpact magnetic printer puts out 50 pages/min

A nonimpact magnetic printer, the MP 6050, achieves a resolution of 240 by 240 dots/in. at a speed of 50 pages/min using office-sized fan-fold paper. This downsized version of the MP 6090, uses the company's proprietary perpendicular magnetographic technology. The printer is said to have a mean time before failure rate of 1 million pages and a drum life rated at 10 million pages.

The MP 6050 permits a page to be printed with rotation in two different directions—0° and 90°—allowing the use of one paper size for a variety of output requirements. The basic model with logic architecture includes



a video interface and a power stacker. It also provides operator/host-selectable densities, and its interface is monodirectional on a character-line-transfer basis.

In original-equipment-manufacturer quantities, the printers sell for \$15,000 each. Evaluation units are scheduled to be available in the fourth quarter.

Cynthia Peripheral Corp., 766 San Aleso Ave., Sunnyvale, Calif. 94806. Phone (408) 745-0855 [Circle 373]

Single system does scanning, laser printing, photocopying

A laser printer, the model 3071, combines scanning, photocopying, and an image overlay process in one product. One version of the 3071 prints 20 pages/min at a resolution of 240 by 240 dots/in., while another version achieves 16 pages/min at 300 by 300 dots/in.

The unit uses laser and halogen-lamp electrophotography for letter-quality printing and copying, respectively. It performs scanning functions by transforming data from hard copy placed on a sliding glass document table into dot data, which is sent to the host computer for further processing. This can also be used for facsimile applications. Image overlay, for adding graphics like a letterhead to printed matter, uses negative image forms for the reproduction of copies.

The 3071, available now, will be sold to original-equip-

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The COMPAQ DESKPRO is the most expandable desktop you can buy. It can grow as you grow, with up to six available expansion slots and four storage devices, including a unique fixed disk drive backup—all *inside the computer instead of out*, saving your desk from clutter.

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It's also the most compatible desktop, giving you true hardware and software compatibility with the industry's most popular personal computers. The COMPAQ DESKPRO runs thousands of programs written for the IBM[®] PC and XT right off the shelf. Which brings us to the next point.

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The industry leader in compatibility.

Text and graphics on one screen, not two.

Power and space for almost unlimited expansion.

Add up to 640K of memory on system board and save expansion slots.

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*10MB fixed disk drive
10MB fixed disk backup
Two diskette drives*

Exclusive tape backup helps protect data.

Unique shock mounting helps protect your data and hardware investment.

Familiar layout enhanced with LED's on caps and num-lock keys.



The COMPAQ DESKPRO is the fastest truly compatible desktop you can buy. It's two to three times faster than the industry standard. That saves time now. And in the future, as software becomes more sophisticated and integrated, it will save you even more time as well as protect your personal computer investment.

But there's more. We gave the COMPAQ DESKPRO one other feature not found on any other machine. You can choose between an amber or green dual-mode monitor that displays high-resolution text *and* graphics with equal

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For the location of the nearest Authorized COMPAQ Computer Dealer, or for a free brochure, call 1-800-231-0900, Operator 5 or Telex #795437 COMPAQCOMP HOU.

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Circle 75 on reader service card

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ment manufacturers as a printer only (with the 300-by-300-dot/in. resolution) or as an integrated printer, copier, and scanner (with the 240-by-240-dots/in. resolution). The 3071 offering all options at a resolution of 300 by 300 dots/in. will be shipped in November. The price of the lower-resolution multifunction 3071, including all options, is \$7,340 in OEM quantities.

The model 3072, a unit equipped with a controller and power supply that is intended exclusively for laser printing, achieves 16 pages/min at a resolution of 300 by 300 dots/in. It costs \$7,865.

Fujitsu America Inc., 3055 Orchard Dr., San Jose, Calif. 95134.
Phone (408) 946-8777 [Circle 374]

System models and simulates plants and other facilities

A modeling package lets users create diagrams of plants or facilities on a color video display. Users working with the visual interactive simulation package, See Why, can also study the effects of alternate layouts and control rules in such complex systems as plants, airports, and conveyor systems.

Priced at about \$50,000, the microcomputer-based package is available within six weeks of ordering.

BLSL Inc., 83 Cambridge St., Burlington, Mass. 01803. Phone (617) 272-7333 [Circle 369]



Compact acquisition system connects with thermocouples

Called the Passport SDAS-8, a compact data-acquisition system accepts eight differential-analog channels and transmits them as ASCII serial data to a host computer. With its asynchronous RS-232-C and isolated current-loop input/output lines, the model SDAS-8 can be located away from hostile factory environments.

The SDAS-8 includes an internal programmable gain amplifier, software linearization, and a separate cold-junction-compensated channel for directly connecting thermocouples. The SDAS-8 is intended for direct sensor input from dc or slowly varying inputs, with a full-scale input range of ± 4.095 V dc per channel. An external precision resistor provides gains up to 200 for direct thermocouple input and other low-level signals. It accepts pin-strapped serial data rates from 75 to 9,600 baud, half- or full-duplex.

Up to four stations with 32 differential channels may be connected to a single full-duplex multidrop serial port using the isolated 20-mA loop. Analog-to-digital resolution is 13 bits, and channel-to-channel common-mode range is ± 11 V to signal ground. It may be connected to the serial port of many computers.

Priced at \$395, the SDAS-8 is available within four weeks of ordering.

Datel, 11 Cabot Blvd., Mansfield, Mass. 02048. Phone (617) 339-9341. Phone (617) 339-9341 [Circle 393]

Thin keyboard gives audible, tactile feedback

The series 89 keyboard, just 1/10 in. thick, uses the company's high-reliability snap-dome contact system to provide metal-to-metal contact to the operator. Each dome contact is rated for 3 million operations, with bounce characteristics that can be buffered for logic compatibility.

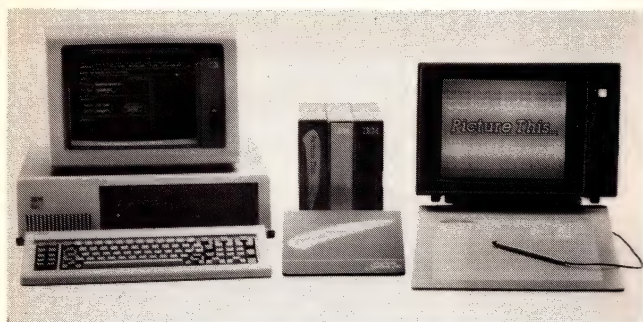
The keyboards, which provide audible and tactile feedback, are available with 3-by-4, 4-by-4, and 5-by-4 button arrangements. Circuitry options include matrix, 2-out-of-7, and single-pole/common-bus. The user can choose between stud or adhesive mounting.

A standard 4-by-4-button keyboard sells for \$13.88 in 100-piece lots; delivery takes up to four weeks for limited quantities.

Grayhill Inc., 561 Hillgrove Ave., LaGrange, Ill. 60525.
Phone (312) 354-1040 [Circle 381]

Option gives IBM PCs 4,096 colors, high resolution

The System 640, a graphics enhancement for the IBM Corp. Personal Computer, provides a 4,096-color palette and over four times the resolution of the standard IBM color-adaptor board and monitor, the company says. Software included with the system lets users create graphics for presentations and reports, and it provides an "electronic slide show" capability through the monitor.



Using an electronic stylus and drawing pad, the user can make, erase, or move drawings and add different colors. A variety of type styles and predrawn art are available. For use with the IBM PC, PC XT, or fully compatible machines, the System 640 is available now. The price, which includes the graphics card, monitor, drawing tablet, and software, is \$7,995.

Chartpak, 19700 Fairchild, Suite 230, Irvine, Calif. 92715. Phone (714) 752-4999 [Circle 367]

Lightweight aircraft switch is readable in sunlight

Readable in sunlight, a switch weighing less than 16 g is designed for military and commercial aircraft. The tiny double-pole double-throw pushbutton device meets a number of military standards for shock, vibration, moisture and salt-spray resistance, and panel sealing. The 0.75-by-0.75-by-1-in. series 580 switch leaves cockpit designers space for other features. Users can select various lens colors, legends, and terminations. Priced at under \$50 in lots of 2,500 pieces, the switches are available in 10 to 12 weeks.

Eaton-MSD Products, 1640 Monrovia Ave., Costa Mesa, Calif. 92627. Phone (714) 642-2427 [Circle 358]

Portable emulators provide full debugging capability

A line of portable, stand-alone in-circuit emulators for 8- and 16-bit microprocessors, the SA700 comes as a family of integrated compact emulators providing full symbolic debugging capability independent of a host development system. The 8-bit development systems, SA700 Z80 and M-85, support the Z80 and 8085 8-bit microprocessors and provide full-speed real-time emulation. The 16-bit SA700 M-86/88 is an emulator for the 8086, 8088, and 8087 microprocessors and complements Intel's Microcomputer Development System, Intel's 86/330, and CP/M-86-based systems.

The self-contained emulators include integrated cath-

ode-ray-tube monitor, ASCII keyboard, 8-in. floppy-disk drive, a programmer for programmable read-only memories, logic-state analysis probes, and an in-circuit emulator. Software development and final integration of hardware and software integration can be done without being connected to the host.

The SA700 complements compatible hosts by directly reading executable object files from systems such as Intel's MDS Series II and III, iRMX-86, CP/M-86, and CP/M 2.2. Programs to be debugged can be entered directly from the floppy disk. The SA700 systems are available now and are priced at less than \$10,000.

Sophia Computer Systems Inc., 3337 Kifer Rd., Santa Clara, Calif. 95051. Phone (408) 733-1571 [Circle 399]

60-W switcher comes with dual outputs, emi filter

A 60-W power supply, the model XL060 is an addition to the company's off-line and dc-to-dc switcher lines. The supply features dual outputs, a means of limiting dynamic in-rush current, and an on-board filter for electromagnetic interference; it is 70% to 90% efficient, depending on the load. It typically puts out +5 V at 10 A and +12 V at 2 A.

The model XL060, measuring 3.25 by 7.0 by 1.75 in., comes in two configurations: a printed-circuit card with a three-pin connector, and a pc card with a line receptacle and an on/off switch. Prices of the supply, available now, start at \$59 each in large quantities.

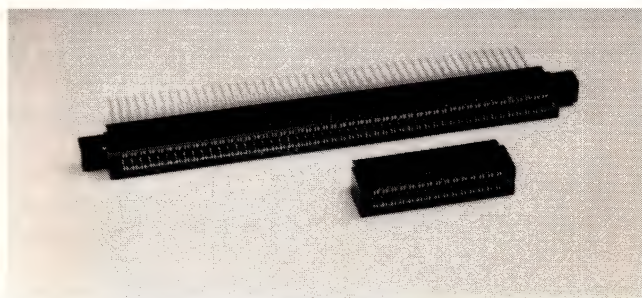
CEI Corp., P.O. Box 501, Londonderry, N.H. 03053. Phone (603) 623-8888 [Circle 385]

Card connector serves makers of IBM PC lookalikes

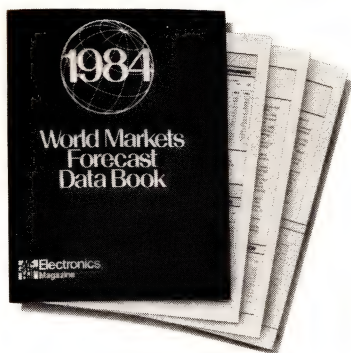
The largest of the 6339 series of 0.1-by-0.2-in. card-edge models, a 62-contact one-piece device, offers high-quality mating of printed-circuit boards to systems compatible with IBM Corp. Personal Computers.

The contacts, compatible with the PC bus, are full-bellows, made of phosphor bronze material, with 0.025-in. posted tails and short tails that are 0.16-in. long for flow-soldering onto the back panel. They are available plated with gold in the mating area and with either gold flash or bright tin-lead tails.

The connector comes in a black, glass-filled plastic phenolic housing that complies with the Underwriters Laboratories flammability rating of



Market Profile



The 1984 World Markets Forecast Data Book is now available! The highly respected 26th annual market forecast has been updated and expanded to provide an analytical profile of the current and future demands of the electronics market. The 1984 edition covers 845 products in the categories of semiconductors, components, communications, data-processing, industrial consumer and test and measurement equipment.

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94V-O. Available within six weeks of ordering, the connector is priced at 3¢/contact position in quantities of 5,000 to 10,000 units.

Elco Corp., 74 Brookhollow Dr., Santa Ana, Calif. 92705.

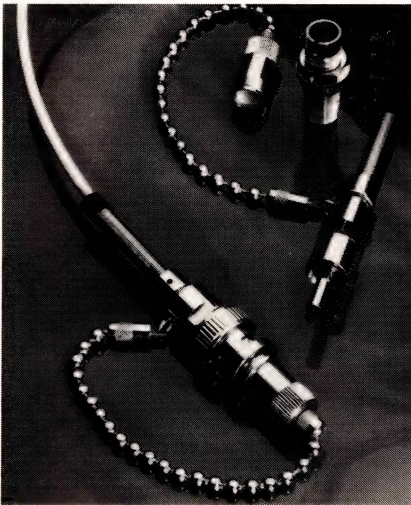
Phone (714) 641-2040

[Circle 379]

Multimode connector couples and decouples easily

A multimode connector features a bayonet (BNC) coupling for quick and easy connection and disconnection. The model GFS-3/B has a typical insertion loss of 0.6 dB on a non-matched pair, with no index-matching fluid.

Using the company's crimping and swaging technique, technicians can make a connection in the field in less



than 10 min., the company says. Positioning for the bare filter is accomplished with a precision of better than 1 μ m. High-precision ferrules made of tungsten provide stability and reliability, and operating temperatures range from -20 to +85° C.

Available now, the basic connector without an adapter sells for \$50.42. Interoptics, 770 Airport Blvd., Burlingame, Calif. 94010.

Phone (415) 347-8217

[Circle 382]

CATV unit uses scramblers to lock out nonsubscribers

The Guardsman, which can add up to six premium pay channels to any cable television system, uses off-premise scramblers to keep nonsubscri-



ers from gaining access. It can be configured as an addressable, non-addressable, or hybrid addressable/non-addressable system.

An address encoder located at the head provides channel and tier authorization to the individual scramblers throughout the community-access TV system. The encoder also links with the central billing station to provide essential commands, message validations, and data. The Guardsman module can be mounted on a stand, pole, or pedestal and has a plug-in ac transformer and power/radio-frequency duplexer for the subscriber's home.

According to the company, the price and setup time for the Guardsman are based on the system's requirements and the number of subscribers. Therefore, they vary from installation to installation.

Blonder-Tongue Laboratories Inc., 1 Jake Brown Rd., Old Bridge, N.J. 08857.

Phone (201) 679-4000

[Circle 386]

With multiplexer, 16 terminals communicate over single line

A statistical multiplexer allows from 4 to 16 remote data terminals to communicate concurrently with a central computer at rates of up to 9,600 bits/s on a single telephone line. The Smartmux monitors individual channels and maximizes data transmission while ensuring that interactive traffic takes precedence over batch.

It can buffer data prior to transmission and can transmit variable-length data blocks according to the loading on the individual channels. It can check data blocks received on the high-speed line and request retransmission in the event of errors.

SYSTEMS INTERFACES

The multiplexer can be expanded from 4 to 16 channels in four-channel increments for both synchronous and asynchronous applications, supporting a range of computer system protocols. Available now for immediate delivery, the multiplexer ranges from \$1,850 for the 4-channel model to \$7,200 for the 16-channel model, both with a 9,600-bits/s modem.

Anderson Jacobson Inc., 521 Charcot Ave., San Jose, Calif. 95131.

Phone (408) 945-9030

[Circle 387]

Controllers let three units share a single printer

With two additions to the company's line of controllers, the ESI-2016 and ESI-2018, up to three personal computers can share one printer. The intelligent controllers, which automatically buffer and manage print output, require only one full-length option slot in one IBM Corp. Personal Computer XT and use none of its processing time.

The controllers, one for serial printers and one for parallel printers, come with 64-K bytes of memory and a splitter cable. Priced at \$595 each, they are available in 30 days.

Extended Systems, 6062 Morris Hill La., P.O. Box 4937, Boise, Idaho 83711.

Phone (208) 322-7163

[Circle 388]

Software lets computers access IBM and DEC systems

A series of communications products lets users of computers linked on Ethernets gain access to computers from IBM Corp. and Digital Equipment Corp. With one of these, the Xerox 8010 Star work stations can emulate IBM 3278 display terminals, providing compatibility with Systems Network Architecture protocols.

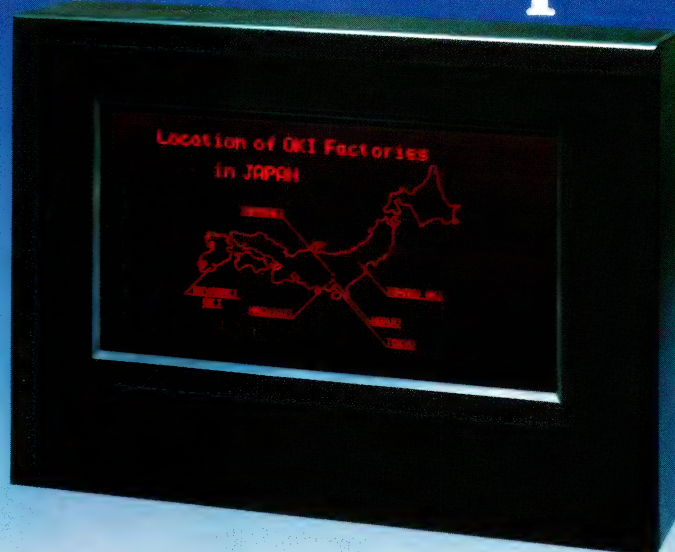
Xerox will also provide software that lets its Star work station emulate a DEC VT-100 terminal. The SNA option and the DEC VT-100 emulation will be available in October. The company says prices will range from \$200 to \$1,500.

Xerox Corp., Office Systems Division, 3333 Coyote Hill Rd., Palo Alto, Calif. 94394.

Phone (415) 494-5859

[Circle 389]

OKI Announces a New Era in Plasma Graphics



The OKI SS Series of plasma displays offers a new way of communicating complex ideas for industry and the consumer. The flat displays provide a compact alternative to bulky CRTs in personal computers. Fine resolution and elimination of flicker and glare reduce operator eye-strain and fatigue.

Other applications include point of sale and banking terminals, measuring instruments and numerical control machines.

● SS640400R

(W 640 dots x H 400 dots: Neon orange)
(Under development)

● SS480240R

(W 480 dots x H 240 dots: Neon orange)

● SS320160R

(W 320 dots x H 160 dots: Neon orange)

● SS256128R

(W 256 dots x H 128 dots: Neon orange)

● SS192020R

(W 192 dots x H 20 dots: Neon orange)

● SS096016R

(W 96 dots x H 16 dots: Neon orange)



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New Literature

Process control. Containing tables of engineering data commonly used in process control, a brochure includes an updated table of unit conversion factors that incorporates calculations both to and from International Standards Units. Also included in *Units and Conversion Tables for Process Control* are tables for comparable Fahrenheit and Celsius temperatures, properties of saturated steam and saturated water, weight and other factors of liquids at many different specific gravities, stainless-steel composition, and physical constants of natural gas components. For a free copy of Pub 73B, call (617) 543-8750 or write to The Foxboro Co., Public Relations Dept., Foxboro, Mass. 02035. [Circle reader service number 421]

The logical choice. Using a 40-page guide to the selection and use of logic analyzers, designers can evaluate their equipment needs in terms of state analysis, timing measurements, and software performance analysis. The guide provides a flow diagram to aid in the selection process, as well as summaries of Dolch's line of instruments, from the 32-channel LAM 3250 to the more sophisticated Colt or Atlas digital work stations. Also included are descriptions of plug-ins and accessories available for the work stations. For a complimentary copy, call (408) 945-1881 or write to Dolch Logic Instruments Inc., 2029 O'Toole Ave., San Jose, Calif. 95131. [Circle 422]

Surface mounting. The second edition of *Surface Mount Technology Design Guideline Book* helps design engineers prepare artmasters for manufacturing hybrid or surface-mounted printed-circuit boards as well as ensure the best possible results for all phases of a product's fabrication and assembly. For a copy or for more information, call NuGrafix Group Inc., (408) 395-5859, or write to the company at 59 N. Santa Cruz Ave., Los Gatos, Calif. 95030. [Circle 424]

Divide and conquer. A four-page application note titled *Multitasking: The Divide-and-Conquer Approach to*

Programming describes the use of multitasking to control complex industrial machines. With multitasking, several programs can be executed simultaneously on a programmable controller. The note illustrates several program examples and explains them in detail, along with describing how they can be used in practical applications. It also describes an approach for automatic fault detection and correction. For a copy or for more information, write to Control Technology Corp., at 82 Turnpike Rd., Westboro, Mass. 01581, or call (617) 366-9668.

[Circle 423]

Transformer design. A 32-page transformer design manual describes line matching, audio, hybrid, and power transformers along with inductors, holding rails, and retard coils. Available in a wide range of mechanical packages—including low profile, split bobbin, horizontal, vertical, and "dry and wet"—these designs are suitable for the telecommunications and data processing industries. To receive a free copy, write to James Electronics Inc., 4050 N. Rockwell St., Chicago, Ill. 60618, or call (312) 463-6500.

[Circle 425]

Custom CRTs. The complete line of Zenith Electronics Corp.'s custom monochrome displays from 5 through 15 in. diagonally measured, intended for original-equipment manufacturers, is described in an 18-page brochure. Also discussed are the line's wide selection of options, including cabinetry, logic boards, and auxiliary power. The brochure is free from the Systems and Components Group at 1000 Milwaukee Ave., Glenview, Ill. 60025, (312) 391-8795.

[Circle 426]

Chromatography. The latest issue (Vol. 11, No. 2) of *Chromatography Review*, from the Autolab Division of Spectra-Physics, features applications of the company's instruments in the solution of chromatographic problems. Among the six papers, by investigators from outside and within the firm, in the current issue is "Continuous Flow Analysis: The Auto-Analyzer." For a current issue,

call Spectra-Physics Inc. at (408) 946-6080 or write to 3333 N. First St., San Jose, Calif. 95134.

[Circle 427]

Custom VMEbus products. A brochure that describes MicroDimensions' development services for microprocessor systems details its design and prototyping capabilities. Specializing in the 68000 microprocessor and the VMEbus, the company produces custom systems and modules, including analog-to-digital, power input/output, motion-control, and others. Other support services described include software development for the custom products as well as for standard systems. For more information, write to MicroDimensions Inc., 30432 Euclid Ave., Wickliffe, Ohio 44092.

[Circle 429]

Seeing-eye machines. Besides covering the company's own products, Pattern Processing Technologies Inc.'s booklet *Machine Vision Systems* discusses the development of the machine vision industry and presents industrial applications. The booklet is designed to give readers a perspective on the industry's current direction. For a copy, call the company at (612) 339-8488 or write to 511 Eleventh Ave. South, Minneapolis, Minn. 55415.

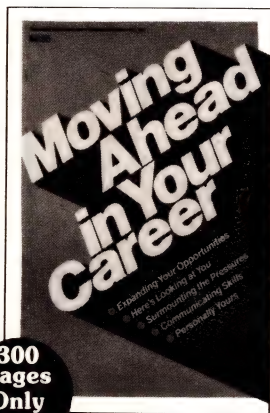
[Circle 428]

Up close. Scanning electron microscopes and equipment designed to meet the requirements of semiconductor development and production are discussed in a catalog from Cambridge Instruments Inc. Industrial products such as valves, cylinders, carbon index controllers, and robotic vision systems are also included. In addition, the catalog provides information on semiconductor material (notably high-purity III-V compounds), a lithography system able to meet both research and production needs, and a reticle inspection and line-width measurement system. The brochure also includes a brief explanation of the applications and capabilities of each system. For a free copy, call (914) 356-3331 or write to Cambridge Instruments Inc., 40 Robert Pitt Dr., Monsey, N.Y. 10952.

[Circle 430]

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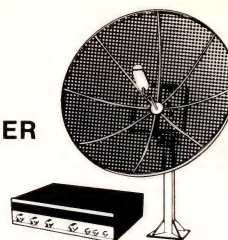
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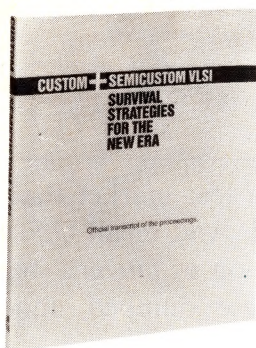


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NOW IS THE TIME TO HALT DUMPING

The Electronics Industry Association's telecommunications group is thinking of putting its name on a call for trade sanctions against Japan's Kokusai Electric Co. The group is troubled by what it considers Kokusai's attempts to dump cellular telephone base station transceivers on U.S. shores: the allegation is that they would be available to U.S. consumers for 40% of their true cost.

The burr has been under the EIA's saddle since January, when E.F. Johnson Co. filed an antidumping petition with the International Trade Commission. Johnson, of Waseca, Minn., had bid more than double the Japanese company, which won a \$1.5 million contract from Western Electric to supply what was then more than half of the cell-site transmitters licensed in the U.S.

As Johnson saw it at the time, it was the victim of a clearcut case of anticompetitive industrial targeting. Now, several months later, it appears that the EIA is viewing the case the same way [*ElectronicsWeek*, July 30, 1984, p. 26]. We see no reason to argue with the assessment put forth by either party and applaud the EIA for bringing attention to this latest predatory maneuver by yet another Japanese manufacturer.

But what is equally disturbing is that the lessons of the past take so painfully long to register in the regulations of the present. This attempt by a Japanese firm to use what appear to be unfair means to capture foreign markets is just the latest in a long line of such forays.

Motorola spent considerable sums of money and months of legal effort to end the practice in the pocket-pager market. The U.S. television industry had to suffer years of inaction on the part of the government before it finally received its day in court concerning Japanese dumping. The harvest of indecision for the

U.S. TV makers was a lost market that likely will never be recovered. And recall U.S. manufacturers' market position in citizens' band radio before the Japanese dumped under-cost products in this country.

The EIA has put off a final decision on the filing of charges until October, taking these next few months to once again study the problem. That's fine, except that we are concerned that the trade group may read more into recent Japanese attempts to mollify angry victims than is actually there and decide not to file the complaint.

For example, the lower house of the Diet, Japan's national legislature, recently approved a series of acts that would turn Nippon Telegraph & Telephone Public Corp. into a private company and along with that, permit foreign firms to supply some value-added-services to the NTT network. The move seems to be timed to cap the head of steam rising within the EIA, or at least to reduce it to a mere wisp by October.

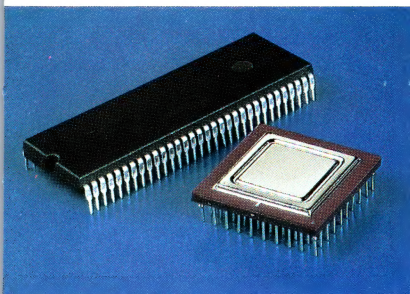
The EIA must make its deliberations in an atmosphere of calm and not be swayed by half measures undertaken in Tokyo. The willingness of the Japanese to allow foreign, even U.S., firms to supply value-added-network services for its businesses should not be seen as a substitute for strong antidumping action in the U.S. They have nothing in common: the NTT moves merely reflect business realities in the Japanese communications market and in no way undo the harm of dumping.

It is long past the time for Japan to begin playing fair on the world markets. Such organizations as the EIA and the Semiconductor Industry Association—which stopped short of a sanctions call last year when Tokyo appeased it with an agreement to eliminate tariffs on semiconductors—must carry the banner.



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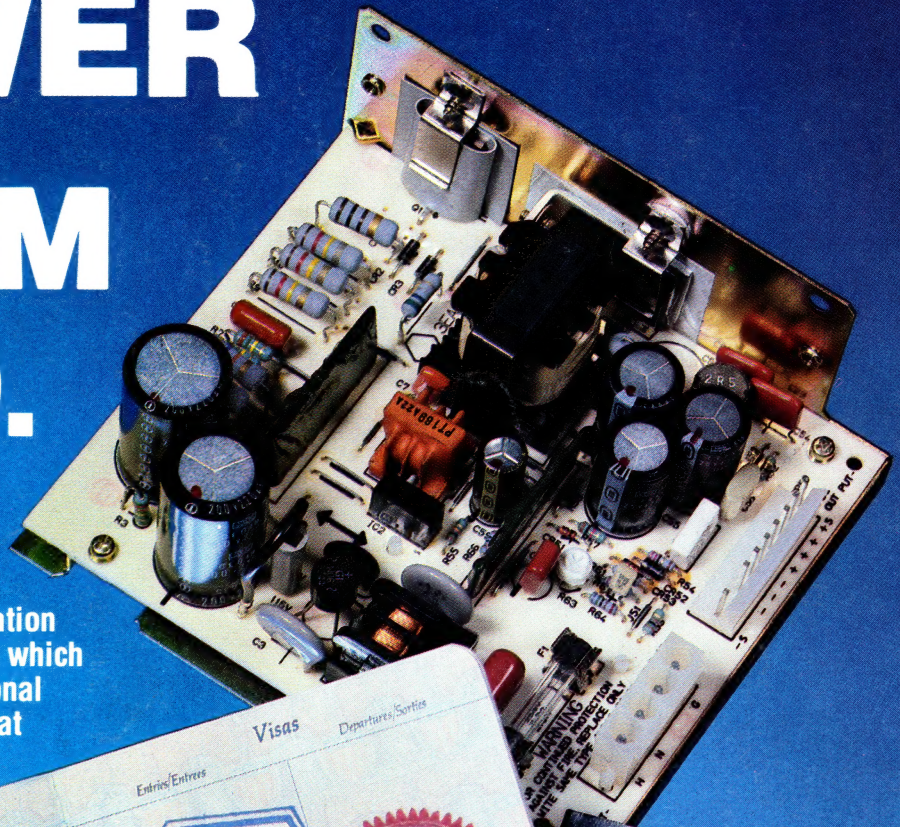
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	1,400	TC15G014P (88)	TC17G014P (82)
	2,200	TC15G022P (110)	TC17G022P (102)
	3,200	TC15G032P (134)	TC17G032P (124)
	4,200	TC15G042P (152)	TC17G042P (146)
	6,000	TC15G060P (176)	TC17G060P (182)
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